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## SIR RICHARD OWEN: HIS LIFE AND WORKS.*

By C. W. G. Rohrer, M. A., M. D., Ph. D., Baltimore.

Doubtless some of you have questioned yourselves concerning the "why and wherefore" for this paper, entitled "Sir Richard Owen: His Life and Works." I wish to give three brief reasons for thus imposing upon your time and good nature.

1. Because of Professor Owen's contributions to medical science.
2. Because of Professor Owen's contributions to the allied sciences. And,
3. For purely sentimental reasons. On Monday, April 4, 1898, when I was a second-year medical student, I attended a Young Men's Christian Association lecture delivered by the late Dr. Daniel C. Gilman, an honored president of this university. In the course of Dr. Gilman's remarks he gave us the following terse bit of advice: "Read biography. Familiarize yourself with the lives of the good and great."

### Birth and Parentage.

Richard Owen, the subject of my sketch, was born on Thurnham Street in the town of Lancaster, England, on July 20, 1804. He was the younger son of Richard Owen, formerly of Fulmer Place, Bucks. His grandfather, William Owen, married Elizabeth, daughter of Richard Eskrigge. This Richard Eskrigge was high sheriff of Bucks in 1741, and was the owner of Fulmer Place. In an old family prayer book, dated 1713, with a frontispiece portrait of Queen Anne, and further "adorn'd," as the title-page has it, "with 50 historical cuts," there are the following entries in Richard Eskrigge's handwriting:

Richard Owen, son of William Owen (who was free of the Fishmongers' Company) and of Elizabeth Owen. The said Richard was born in the parish of St. Matthew, Friday Street, December 5, 1754, and baptized the Sunday following. The sponsors were Richard and Elizabeth Eskrigge and Mr. Beresford (Cashier in the Bank of England)."

Then, in Sir Richard Owen's handwriting, a few explanatory remarks are added. He writes:

The above entries are in the handwriting of my great-grandfather, Richard Eskrigge, of Fulmer Place, Fulmer, Bucks, and relate to the birth of his grandson and heir, my father, Richard Owen.

There is also the following entry in the handwriting of Sir Richard Owen's father:

Richard and Catherine Owen were married at Preston, November 8, 1792, by the Rev. H. Shuttleworth.

This latter Richard Owen was Sir Richard Owen's father, and the Catherine Owen mentioned was Sir Richard Owen's mother. Sir Richard Owen's mother was of French extrac-

*Paper read before the Johns Hopkins Hospital Historical Club, January 9, 1911.

tion. She was of a Huguenot family of the name of Parrin, who came over from Provence at the revocation of the Edict of Nantes. Her full maiden name was Catherine Longworth Parrin.

Sir Richard Owen's mother, besides being a woman of great refinement and intelligence, was an accomplished musician. Her father before her had supported himself by the profession of music, and she inherited his talent. In appearance she was a handsome, Spanish-looking woman, with dark eyes and hair. Owen himself never tired of speaking of his mother's charm of manner, and of all that he owed to her early training and example.

Sir Richard Owen's father was a complete contrast. Tall, stout and ruddy, his general appearance bore a strong resemblance to the face and figure popularly supposed to belong to the typical John Bull. Nor was his character unlike —bluff, burly, obstinate, and perhaps not particularly brilliant, he was yet possessed of sound common sense.

### Childhood and Youth.

Sir Richard Owen as a school-boy succeeded admirably with his studies. In 1808, when Owen was but four years of age, his father, a West India merchant, and often absent from home, included the following sentence in a letter to his wife: "I am glad to know James and Richard come on so well with their studies and are so attentive." James was Professor Owen's elder brother.

After the above preparatory instruction given by an old Quaker lady, Richard Owen, at the mature age of six, was sent to the Lancaster Grammar School to join his elder brother James. Whewell, the famous master of Trinity, who was Owen's fellow-townsman, also received the first rudiments of his education at this school. Another school-fellow who was in the same class as Owen's elder brother was Higgin, late Bishop of Derry.

One of Owen's teachers in the Lancaster Grammar School stigmatized him as "lazy and impudent," and prophesied that he would come to a bad end. This gentleman gave instruction in penmanship. However, in spite of his dismal predictions he managed to teach Owen to write a remarkably clear and neat hand, which hardly varied till within a few years of his death.

"At this period of his life," as Professor Owen's last surviving sister would relate, "Richard was very small and slight and exceedingly mischievous, and he hardly grew at all until he was sixteen."

Owen's family were evidently apprehensive that it would end by his being a "small man." But he soon began to make up for his early want of stature, and when he left the Grammar School he was already a big, awkward lad. At mature manhood Professor Owen's height was six feet in his socks.

At the age of fourteen Richard Owen had given no signs of a taste for the work to which his life was afterwards devoted. Part of a manuscript treatise on "Heraldry" still exists, which he wrote about this time, as well as an elaborately painted coat of arms of the Owen and Eskrigge family.

### Early Education.

Soon after leaving school Richard Owen was apprenticed to "Leonard Dickson, of Lancaster, Surgeon and Apothecary," as his indenture dated August 11, 1820, shows. According to the terms of this document Owen was to be provided by his mother with "meat, drink, washing and lodging, and also decent and suitable clothes and wearing apparel," and his master was on his part to teach him the "arts, businesses, professions, and mysteries of a surgeon-apothecary and man midwife, with every circumstance relating thereto."

Mr. Dickson died two years after, and Richard Owen was "assigned, transferred, and turned over" by the executors to Joseph Seed for the term of five years, the indenture of this transfer bearing the date of June 19, 1822. The following year Mr. Seed accepted a post as surgeon in the Royal Navy, and Owen was again transferred, by an indenture dated December 13, 1823, to James Stockdale Harrison, "Surgeon and Apothecary."

There is appended to the indenture to Seed a certificate in Joseph Seed's handwriting, which contains the following paragraph:

> **Mr. Richard Owen's general conduct during the time he was with me has my highest commendation, and at all times I shall be happy to bear testimony to his most deserving merit, as well as to his respectability.**
>
> **(Signed) J. Seed,**
> **Surgeon Royal Navy.**
>
> **Lancaster, January 10, 1827.**

The terms of Owen's surgical apprenticeship at Lancaster were never carried out to the full. In October, 1824, he matriculated at Edinburgh University. Some of his lecture cards of admission are still preserved. We gather from them that he attended, besides numerous other lectures, the anatomical lectures of Monro (tertius); but as that worthy gentleman was in the habit of lecturing—so Owen had remarked —from the notes used by his grandfather and his father, both of whom had successively occupied the chair of anatomy before him, these lectures were found to be neither of particular interest nor yet sufficiently up to date. So Owen was constrained to attend the outside course given by Dr. Barclay on practical anatomy, and anatomy and surgery. Though this was an extra which he could ill afford, still he never regretted it, for of all his teachers at Edinburgh it was to Dr. John Barclay that he owed the most. Many times had Owen spoken of the influence that Dr. John Barclay had on his early career, and the sincere affection with which he inspired him. At this time there were but two lecturers on anatomy in Edinburgh—Dr. Monro and Dr. Barclay. Liston entered the arena as number three.

At the end of April, 1825, Dr. Barclay strongly advised Owen to move to St. Bartholomew's Hospital, London, and study under Abernethy. After some consideration, Owen decided to do so, and obtained his college certificates forthwith, all of which are in existence.

Dr. Barclay (April 25, 1825) speaks of Owen in the following terms in his certificate: "I had much reason to be satisfied with the mode of his attendance, and the manner in which he prosecuted these branches of his medical studies" (anatomy and surgery).

But Dr. Barclay's chief recommendation was a private letter to his friend Abernethy, which he gave to Owen to take to London with him.

Owen was a perfect stranger when he arrived in London. The only connection which he had with his northern friends was Dr. John Barclay's letter of introduction to Dr. Abernethy. This, however, subserved a most useful purpose.

Abernethy had just finished lecturing when Owen arrived at St. Bartholomew's Hospital. He received Owen rather gruffly. Owen presented his letter of introduction from Dr. Barclay. Abernethy read it hurriedly, stuffed it into his pocket and made an appointment with Owen to breakfast with him at eight o'clock the next morning.

When Owen presented himself at Abernethy's residence the next morning he anticipated anything but an agreeable conference with the great physician and surgeon. He found him, to his great surprise, considerably smoothed down and quite pleasant in manner. The result of this meeting was, that Abernethy offered him the post of prosector for his lectures.

To young Owen this was a very desirable position. It possessed several obvious advantages. The prosector was relieved of the necessity of purchasing his own subjects for dissection—no inconsiderable item of expenditure then. This unexpected source of revenue was indeed a saving grace to the young medical student. Owen's father, having suffered severe financial loss, died of a broken heart in 1809, when the boy Richard was but five years old. The mother and six children, two sons and four daughters, were not left penniless, but their means of support were quite meager. For these reasons Richard Owen was early largely thrown upon his own resources.

From such a chief as Abernethy, Owen could not fail to profit. His prosectorship brought with it another decided advantage—the subjects provided for the lectures were in a much sounder and fresher condition, comparatively speaking, than was usually the case in those ever-memorable body-snatching days. To the mind of your humble speaker, this so-called "body-snatching" epoch forms one of the most interesting periods in the whole history of medicine. The wonderful story of John Hunter's persevering efforts to obtain the body of O'Brien, the Irish giant, who died in 1783, should be read by every medical student.

As a rule, Owen fared well at the hands of his professor, Dr. Abernethy; but on one occasion he provoked Abernethy to anger. The lecture was on the human kidney, which Owen had duly prepared. But, unfortunately, in the process of preparation the adrenal gland became detached, owing, most likely, to its not being quite so fresh as it might have been, and, in a great hurry, the prosector carefully fixed it on again—but to the wrong end of the kidney. Abernethy's explanations were somewhat far advanced before he found this out, and not looking very closely at the specimen he held in his hand, he was elaborately describing its structure, as if it had been a normal kidney. When he discovered the error committed, he did not let the occasion pass without bestowing a few flowers of speech upon his young friend.

### Professional Career.

On August 18, 1826, Owen obtained his membership of the Royal College of Surgeons. He had then just entered his twenty-third year. His diploma is signed by twelve great men, the three most familiar ones being John Abernethy, Astley Cooper and Everard Home (John Hunter's brother-in-law).

Owen set up as a medical practitioner at 11 Cook's Court, Carey Street, Lincoln's Inn Fields, and gradually secured a small practice among the lawyers. He also diligently visited the poorer classes of the neighborhood.

John Hunter having died in 1793, his rare, valuable and unusually complete collections numbering 3970 specimens were purchased by the government for the sum of $75,000 and given into the custody of the Royal College of Surgeons. Down to this time (1826) these Hunterian collections had been sadly neglected. For twenty-five years Sir Everard Home was "going to" prepare a descriptive catalogue of the collections which had been transferred by the government from John Hunter's temporary museum in Castle Street to the Royal College of Surgeons.

Owen's peculiar ability as a dissector had not escaped the eagle eye of Abernethy, then president of the Royal College of Surgeons. Abernethy, who was much concerned at the neglect of the collections formed by John Hunter, which had recently been purchased by the government and handed over to the care of the college, insisted on his old pupil, Richard Owen, undertaking their arrangement. As Abernethy said: "The collection was located near his (Owen's) private residence; he could devote his leisure hours to the work; there was no one else equally qualified to do so." Owen undertook the task, and was thus associated with William Clift, at that time conservator of the college museum, and who subsequently became his father-in-law.

In the year 1828 Owen was appointed lecturer on comparative anatomy at St. Bartholomew's Hospital, an appointment which was the starting point of his career as a lecturer. Early in 1834 Owen was appointed professor of comparative anatomy at St. Bartholomew's.

In April, 1836, Owen was appointed Hunterian professor at the Royal College of Surgeons. To the last days of his life he constantly referred to the gratification which this appointment gave him. As Hunterian professor it was Owen's special duty to deliver twenty-four annual lectures, as illustrative of Hunter's collections.

On the retirement of Sir Charles Bell, of Bell's paralysis fame, from the professorship of anatomy and physiology in the Royal College of Surgeons, in the early part of 1837, Owen was elected to the vacant chair. Owen's full title then

became "Hunterian Professor and Professor of Anatomy and Physiology in the Royal College of Surgeons."

Owen now (in 1837) began gradually to relinquish his medical practice in order to devote the whole of his time to scientific research. He had been a practitioner of medicine and surgery for eleven years.

On May 2, 1837, at 5 o'clock p. m., Professor Owen delivered his first Hunterian lecture. The subject of this course of lectures was the microscopical structure and nature of the teeth.

On June 19, 1837, Owen was elected Fullerian professor of comparative anatomy and physiology to the Royal Institution. This professorship Owen was obliged to decline.

Owen filled the position of Hunterian professor of anatomy and physiology at the Royal College of Surgeons for a period of twenty years (1836 to 1856). On May 26, 1856, Owen was appointed superintendent of the natural history department of the British Museum, at a salary of 800 pounds (about $4000) a year. This appointment was originally suggested by Lord Macaulay. The office of superintendent was generally understood to have been created expressly for Owen.

Long after Macaulay had abandoned all other public business, he continued to occupy himself in the administration of the British Museum. In February, 1856, he wrote to Lord Lansdowne with the view of securing that old friend's potent influence in favor of an arrangement by which Professor Owen might be placed in a position worthy of his reputation and of his services. The following is an extract from Macaulay's letter to Lord Lansdowne, in which he proposes that Professor Owen should be constituted superintendent of the whole department of natural history, including geology, zoölogy, botany and mineralogy.

Macaulay writes:

> I cannot but think that this arrangement would be beneficial in the highest degree to the Museum. I am sure it would be popular. I must add that I am extremely desirous that something should be done for Owen. I hardly know him to speak to. His pursuits are not mine; but his fame is spread over Europe. He is an honour to our country, and it is painful to me to think that a man of his merit should be approaching old age amidst anxieties and distresses. He told me that eight hundred a year (meaning 800 pounds a year) without a house in the Museum, would be opulence to him. He did not, he said, even wish for more. He seems to me to be a case for public patronage. Such patronage is not needed by eminent literary men or artists. A poet, a novelist, an historian, a painter, a sculptor, who stood in his own line as high as Owen stands among men of science, could never be in want except by his own fault. But the greatest natural philosopher may starve while his countrymen are boasting of his discoveries, and while foreign Academies are begging for the honor of being allowed to add his name to their list.

Professor Owen entered upon the duties of his new office, that of superintendent of the natural history department of the British Museum, on June 8, 1856. This position Professor Owen held for twenty-eight years, or until he had almost reached the eightieth year of his age.

The superintendency gave Professor Owen an opportunity to do a little outside work. In 1857 Professor Owen was appointed lecturer on palæontology at the Royal School of Mines. His first lecture was given on February 26, at the Museum of Practical Geology. Amongst the audience, as an entry in the diary shows, were many old friends: Dr. Livingstone, Frank Buckland, the Duke of Argyll, with his sons, Sir Charles Lyell and Sir Roderick Murchison.

Towards the end of 1857 Owen was offered and accepted an appointment which some years previously, while at the Royal College of Surgeons he was obliged to decline; it was the Fullerian professorship of physiology at the Royal Institution of Great Britain.

### Private Life.

Professor Owen was one of the most affable of men. His home-life was ideal. In scientific circles he was universally loved and respected. Even those whose views ran counter to his own always dealt with him with the highest consideration. His earnestness of purpose, his sincerity and frankness, were marked traits of his character.

On July 20, 1835, Professor Owen's thirty-first birthday, the event took place to which he had so long looked forward, namely, his marriage to Miss Caroline Clift. Professor Owen had been engaged to Miss Clift for eight years. It was a very quiet wedding, and is thus described in Miss Clift's diary:

> July 20.—Richard Owen and I, my father and Harriet Sheppard, were in the new St. Pancras Church, Euston Square, by half-past eight o'clock. The Rev. Mr. Laing came immediately after we got into the vestry, and, Caroline Clift having been lost on the road, Mrs. Richard Owen returned to breakfast at No. 1. Euston Grove; after which my husband, my mother and I set off to Oxford.

This union was blessed with one child, William Owen, born October 6, 1837. On October 6, Professor Owen writes in his wife's diary:

> At a quarter-past nine William Owen was born.

The next day there is the entry:

> Papa's joy a little damped by excruciating toothache. Mother and child as well as possible.

About a month afterwards Mrs. Owen begins the diary again. The diaries of Mrs. Owen, began about the year 1827, are now kept almost without a break up to 1873, the year of her death, thus covering a period of at least forty-six years. Many of the scenes and incidents in Professor Owen's life, which I have incorporated in this paper, have been taken from Mrs. Owen's interesting diary.

Mrs. Owen died May 7, 1873, and by her death Professor Owen lost one who had been his fitting helpmate for nearly forty years, and who had, in her younger days especially, assisted his work in no small degree by her acute powers of observation and by her artistic skill.

### Contributions to Medical Science.

Owen's most important contribution to medical science is his discovery of the *Trichina spiralis*, a small nematoid worm which harbors in striated muscle and causes the disease known

as trichinosis. This important miscroscopic discovery was made by Owen in the autumn of 1834. At first it seemed merely a curiosity of science. Mr. Wormald, demonstrator of anatomy at St. Bartholomew's Hospital, sent Professor Owen a piece of human muscle accompanied by the following letter:

DEAR OWEN.—I send you some sort of organised beings, as I believe, which occupy the muscles of a subject now under dissection at St. Bartholomew's Hospital, and as I know you are a keen hand for parasitical things from crabs downwards, I send the enclosed for your inspection.

Ever yours sincerely,

THO. WORMALD.

Upon examining this piece of muscle, Owen discovered a new entozoon, the *Trichina spiralis*. Owen's nomenclature has been slightly changed, and in your recent text-books on pathology you will find this parasite spoken of as the *Trichinella spiralis*. Owen's paper, entitled "Description of a Microscopic Entozoon infesting the Muscles of the Human Body," appeared in the *Proceedings of the Zoölogical Society*, Vol. III, 1835.

This minute worm is not limited in its distribution to the muscles of men, but when in the human body not unfrequently causes death. It is well known as producing the epidemic trichinosis, which formerly made its appearance chiefly in Germany, or in such places where diseased pork or partially cooked ham is consumed. Cobbold, in his masterly treatise on parasites, appends a list of thirty-three epidemics of trichinosis observed in Germany during the first six years immediately following the announcement of Professor Owen's discovery of the *Trichina spiralis*.

The *Trichina spiralis* figures conspicuously in Professor Joseph Leidy's excellent monograph, "Flora and Fauna in Living Animals." Dr. Leidy lays especial stress upon the fact that the inhabitants of the United States are less infected with entozoa than the inhabitants of other countries.

Before leaving this important subject it is intensely interesting to note that the medical student who was making the dissection at St. Bartholomew's was Mr. Paget, who afterwards became the renowned Sir James Paget.

Owen was the last great exponent of the so-called "Vertebrate Theory of the Skull." This theory originated in the fertile brain of the German poet Goethe, in the year 1790; it was greatly elaborated in 1807 by Lorenz Oken, a German anatomist; and further developed and most ably championed by Professor Owen about the middle of the nineteenth century. Professor Owen's views are embodied in his "Report on the Archetype and Homologies of the Vertebrate Skeleton," published in 1846.

The vertebral theory of the skull is based upon the hypothesis that the vertebrate skull consists of four modified or expanded vertebræ—in other words, that the skull is the highly differentiated anterior end of the backbone.

While Owen's classic anatomy was faultless, many of his conclusions were subsequently proven by Huxley to be untenable. These were Huxley's words:

The spinal column and the skull start from the same primitive condition, whence they immediately begin to diverge.

It may be true to say that there is a primitive identity of structure between the spinal or vertebral column and the skull; but it is no more true that the adult skull is a modified vertebral column than it would be to affirm that the vertebral column is a modified skull.

Professor Owen conferred an inestimable boon upon medical science by editing two octavo volumes of John Hunter's manuscripts. These two volumes of Hunter's unpublished manuscripts, edited by Owen, appeared in 1860, and are entitled "John Hunter's Essays and MSS." These volumes contain essays on natural history, psychology and kindred topics.

Professor Owen was one of the pioneers in public health work and in sanitation. He was chairman of the original Health of Towns' Commission. Sir Henry Littlejohn, the man who made the first sanitary survey of the city of London, mentioned by Dr. Osler in his recent magazine article entitled "Man's Redemption of Man," served with Professor Owen on this commission.

Professor Owen was also a member of the Commission of Sewers and of the Royal Commission on Smithfield Market and the Meat Supply of London.

### CONTRIBUTIONS TO COMPARATIVE ANATOMY AND PHYSIOLOGY.

Owen's contributions to comparative anatomy represent his most exhaustive work. These are largely embodied in his three-volume work, "On the Anatomy and Physiology of Vertebrates," and his one-volume work, "On the Anatomy and Physiology of Invertebrates." Owen was the leading anatomist of the age, and the leading vertebrate anatomist of all time.

An observation which Owen made on the generative organs in the muridæ or mouse and rat family is of interest. This was mentioned in his Hunterian lectures for 1840. The subject of the lectures for this year was "The Comparative Anatomy of the Generative Organs and the Development of the Ovum and Fœtus in the Different Classes of Animals." In these lectures Professor Owen describes for the first time, as separate and distinct glands, the "small glands with a granulated exterior" situated adjacent to the seminal vesicles in the rat and mouse. Previous investigators had described these glandular structures as part of the prostate gland.

Owen also rendered great service to comparative anatomy by pointing out the distinction between homology or structural resemblance and analogy or functional resemblance.

### CONTRIBUTIONS TO ZOÖLOGY.

Owen's contributions to zoölogical literature are almost as innumerable as the sands of the sea. His first zoölogical paper, written in 1830, was "On the Anatomy of the Ourang-outang." In 1832 Owen published his "Memoir on the Pearly Nautilus," the description of which seemed to have given his mind a bent in a definite direction. This was Owen's first work which attracted the attention of scientific men. In the same year Owen published a paper "On the

Mammary Glands of the *Ornithorhynchus paradoxus,*" and another "On the Generation of Marsupial Animals." In 1863 Owen published his "Memoir on the Aye-Aye."

### Contributions to Palæontology.

Owen was the first to identify the mammoth, an extinct hairy elephant, and assign it to its proper place in the zoölogical world. Owen was also the first to properly describe the *Archæopteryx,* an extinct bird possessing reptilian characters and supposed to be the transition link between reptiles and birds. The *Megatherium americanum,* an extinct ground-sloth from South America, was the subject of considerable controversy until the appearance of Owen's memoir.

Owen's most notable contributions to palæontology are contained in his monograph on the "Extinct Wingless Birds of New Zealand." Herein Owen describes with characteristic clearness and thoroughness the apteryx, the dinornis, and the notornis, all extinct birds of New Zealand; and in an appendix he describes the extinct dodo of Mauritius, the garfowl of Newfoundland, and the solitaire of Rodriguez.

Professor Owen described six distinct species of the genus dinornis, ascending respectively from the size of the great bustard to that of the dodo, of the emu and of the ostrich, and finally attaining a stature far surpassing three of the once-deemed most gigantic of birds. This latter is the *Dinornis maximus,* or great moa, a large struthious bird "of a heavier and more sluggish species than the ostrich." Its greatest height, as determined by Professor Owen, was probably sixteen feet.

### Miscellaneous Contributions.

Professor Owen was the most sought-after man in scientific England. He played a considerable rôle in the discovery of the remains of John Hunter, and in their removal from the vaults beneath St. Martin's Church to Westminster Abbey. These events transpired early in 1859, or nearly sixty-six years after John Hunter's death.

All through Owen's life he was regarded as legitimate prey to the numerous inquirers as to the nature and habits of such fabulous monsters as the cockatrice, the phœnix and the bunyip. Even the question of the existence of a sea-serpent was referred to Owen. In 1848-1849 this "Great Sea-serpent" was alleged to have been seen no less than 187 times. The officers and crew of H. M. S. *Dædalus* also gave a description of this sea-monster. In a letter to the Prince Consort, Professor Owen states his opinion that the "animal" seen from the deck of the *Dædalus* was the head and track of a great seal, or sea-lion. About this time there was another sea-serpent seen, of which the particulars were sent to Owen by the Duke of Northumberland. This Owen demonstrated to be the ribbon-fish from the drawing which was sent. *Punch* soon had a parody on the subject, modeled after the famous Mother Goose rhyme, "Who Killed Cock Robin?" *Punch's* lines began:

"Who killed the sea-serpent?"

"'I,' said Professor Owen."

"Scotched, not killed," was Owen's comment on this.

Owen attempted a classification of animals, based on the nervous system. He also founded the science of "Odontography," or the natural history of teeth.

Even obstetrics was not neglected, because in 1842 Owen wrote a paper entitled "Notes on the Birth of the Giraffe at the Zoölogical Society's Gardens, and description of the fetal membranes, and of some of the natural and morbid appearances observed in the dissection of the young animal."

### Summary of Life Work.

Professor Owen's active working life covered the phenomenal period of sixty-five years. His first two papers were on pathological subjects, and were read before the Abernethian Society in 1826: one "On Encysted Calculus of the Urinary Bladder," and the other "A Case of Gluteal Aneurism with Ligature of the Internal Iliac." Owen's first surgical paper was published in 1830. Its subject was "An Account of the Parts concerned in the Aneurism for the Cure of which Dr. Stevens tied the Internal Iliac Artery at Santa Cruz in the Year 1812." Owen's last paper was written in 1889, when its venerable author was eighty-five years of age. It was entitled "A Monograph on the British Fossil Cetacea from the Red Crag."

Owen's published works number 642. These embrace books and monographs in every department of natural history—zoölogy, comparative anatomy, geology, botany, palæontology, anatomy, physiology, geography, chemistry and public health. Owen was one of the earliest workers with the microscope, and a founder and charter member of the Royal Microscopical Society.

Owen received inspiration from the great Cuvier, whom he met in 1831. Owen was called "the British Cuvier."

Owen manifested a great love of chess, of music and of gardening. He was an accomplished 'cellist.

The story of Owen's life has been admirably written by his grandson, the Rev. Richard Owen, M. A. It comprises two volumes. The data contained therein have been largely gleaned from about 1200 of his own letters, written chiefly to his wife and sisters, and from more than 15,000 letters which have been preserved from the voluminous correspondence which Professor Owen received during his long life.

### Degrees and Honors.

Professor Owen received four honorary degrees, including D. C. L. from Oxford and LL. D. from Cambridge. He was awarded fourteen medals and was a member of eighty-three learned and scientific societies. These include the Royal Society, of which he was elected Fellow in 1834, and the Linnæan Society.

### Owen and Evolution.

Professor Owen, being of deep religious convictions, was a sworn foe of evolution. Owen's works teem with references to the "Divine plan" and the "will of the Creator." But

PROFESSOR OWEN AT THE AGE OF 22 YEARS.

PROFESSOR OWEN IN HIS PRIME—AGED 42 YEARS—AS HE LECTURED. HE HOLDS A BONE OF THE DINORNIS MAXIMUS.

PROFESSOR OWEN—AGED 73 YEARS—AND THE SKELETON OF DINORNIS MAXIMUS.

PROFESSOR OWEN—AGED 85 YEARS—AND HIS GRANDDAUGHTER.

the crisis came in 1860, when the British Association for the Advancement of Science met in Oxford, England. That this battle for evolution should take place at this time was a foregone conclusion.

But only one man in the whole world had the courage to openly oppose Professor Owen's views or dissent from his opinions. This was a rising young anatomist twenty-one years Professor Owen's junior. It was none other than that great master-mind of the nineteenth century, namely, Thomas Henry Huxley. Everybody knows who Huxley was. Huxley's name is inseparably blended with the early history of *this* great institution of learning; because it was Huxley's most famous pupil, Dr. H. Newell Martin, who organized the biological department in this university.

Huxley plead eloquently for the cause of evolution. Owen, representing scientific England, and Bishop Wilberforce, representing the church and the populace, as eloquently opposed it. Bishop Wilberforce, in the course of his remarks, turned to Huxley and asked him if it was on his grandfather's side or on his grandmother's side that he was related to an ape.

When Bishop Wilberforce had ended his speech, Huxley arose to his feet, and in his usual calm but earnest demeanor made the following reply, which has become historical:

**"I asserted, and I repeat, that a man has no reason to be ashamed of having an ape for his grandfather. If there were an ancestor whom I should feel shame in recalling, it would be a *man*, a man of restless and versatile intellect, who, not content with an equivocal success in his own sphere of activity, plunges into scientific questions with which he has no real acquaintance, only to obscure them by an aimless rhetoric, and distract the attention of his hearers from the real point at issue by eloquent digressions, and skilled appeals to religious prejudice.**

However, later in life Owen's heart softened toward evolution and evolutionists. Shortly after Louis Agassiz's death, which occurred December 14, 1873, Professor W. J. Stillman of this country visited London and interviewed Professor Owen. Professor Owen spoke feelingly of Agassiz's death, and lamented the fact that our great naturalist had held out so obstinately against evolution. Professor Owen's words were: "If I could have had half-an-hour's conversation with Agassiz, I believe I could have convinced him of the truth of evolution."

After Owen's death in 1892, Huxley wrote a meritorious essay on "Owen's Position in the History of Anatomical Science." It forms the closing chapter in Vol. II, "Life of Owen."

### Closing Years.

On January 5, 1884, Professor Owen was knighted, and henceforth we shall speak of him as Sir Richard Owen.

Sir Richard Owen's last days were spent at Sheen Lodge, the beautiful home in the suburbs of London, presented to him by Her Majesty Queen Victoria, in recognition of his services. Sir Richard Owen enjoyed reasonably good health, notwithstanding his excessive mental application. For twenty years he had suffered with chronic bronchitis. Early in 1890 he had a stroke of paralysis, from which he never entirely recovered. But he rallied from it in marvellous way. From this date on, his hearing became visibly affected.

On August 30, 1892, his old friend, Sir James Paget paid him a visit, and tried to converse with him; but Sir Richard, owing to his great prostration, was unable to sustain the effort long. In reply to the repeated inquiries of Dr. Palmer, his physician, Sir Richard invariably answered: "I feel no pain at all, but I have no desire to rise from this bed."

Towards the end of November Sir Richard grew gradually weaker, and began to take less and less nourishment. From the first week of December he never showed the slightest disposition to rally. On December 16 he ceased to recognize those who were standing around him. His death occurred a little before three o'clock on Sunday morning, December 18, 1892.

Sir Richard Owen's death was not due to any definite disease, but to a gradual decadence of all the vital functions. His days had been bounteously prolonged. He was in his eighty-ninth year.

Sheen Lodge, Richmond Park.

The news of Sir Richard Owen's death, like that of Agassiz and of Darwin, created widespread regret throughout the civilized world. The people of all nations, regardless of race or creed, realized that a great figure, not only of the age but of the century, had passed away. Indeed, the world was made poorer by Sir Richard Owen's death, because it lost an untiring scientific worker and a most genial, kind-hearted man.

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# A FLORENTINE ANATOMIST.*

By Pearce Bailey, M. D., New York.

It was the peculiar good fortune of Leonardo da Vinci to be sought after and applauded during his life and after it to attain what he thought most worth having, permanent fame. Few men whose names have grown greater with succeeding centuries have had such praise from their contemporaries. He was the divine genius, the second Appeles, the man who could do anything. Kings and Popes sought him for his personal charm quite as much as for his constructive genius. Francis I told Cellini that no mortal had ever known as much as Leonardo knew, not only in the arts but in everything else. "Nature had so endowed him," wrote his contemporary biographer, Vasari, "that whenever he put forth thought, will and effort he showed such divine achievement that no one has ever equalled him in readiness, activity, quality of product, amiability and grace."

It is not necessary to define the place posterity has accorded him in the art which is his chief glory. But Stevenson gracefully vouches for his personal qualities by counting him one of the two men he ever knew or heard of worthy of a woman's falling in love with; and as the beginnings of science are day by day being unearthed from old manuscripts, almost as many champions are coming forward now to prove him a pioneer genius as there were then who praised and loved him during his life. Great as are his works of art, the most impressive legacy he left are the evidences of the universality of his genius.

> Philosophe, physicien
> Rimeur, bretteur musicien
> Et voyageur aerien.

He was all that, but far more. He caught from the blue ideas that had occurred to no one before, and now are everybody's. He made definite impressions on geology, astronomy, engineering, mechanics, botany, zoölogy, physiology, anatomy. He made no great discoveries. But he foreshadowed all discovery from the theory of cosmic unity to the rural free delivery and the lighter than air machines. He is to be judged by his insight and the breadth of his conceptions rather than by his finished products. What he did produce was of such a high degree of excellence that it is impossible to imagine his doing anything badly.

He had the will to attack, without which no one can be first. In his note-books may be found frequent phillipics against alchemists, necromancers, astrologists and physicians, all of whom, in his day, were opposed to the scientific idea. A thinker who can twist a horseshoe with his hands as though it were lead is rarely one to keep his views to himself; and we may think of him as a noble figure with a long beard who wore a red cloak which reached to his knees; one who defied the fashions, a militant missionary of freedom of thought and progress. Leonardo's love of nature and his profession of sculptor and painter early led him to a study of animal structure. He made notes for a book on how birds fly, and for another on the anatomy of the horse. And with the help of chance association or his policy of thoroughness, he became the first to know how the parts of a man are welded together to make him a mechanical unit.

One cannot appreciate what this meant in originality and daring without first knowing how little medicine was developed before the Renaissance. If we look back to the early growth of anatomy as an exact and special study, three landmarks stand out clearly between the misty beginnings and the time, in the third century, A. D., when rational knowledge, held in the bosom of the church, went to its long sleep.

These landmarks are Greece with Hippocrates towering over everything, Alexandria with its famous school, and Rome in the time of Marcus Aurelius, when Galen established anatomical teachings which were to be blindly followed for a thousand years.

Hippocrates (d. 380 B. C.) did little more for anatomy than to crystallize the vague conceptions of his predecessors, none of which were based on human dissections. The laws of Greece required prompt burial of the dead, and that the buried dead be left to sleep in peace. The few anatomical facts, therefore, which Greek medicine separated from myth and tradition were gleaned by such disclosures of anatomical structure as were made by the wounds and injuries of war, by unburied bodies which had been separated into their integral parts by the elements, and by sacrificial animals. As a result, the anatomy of the times boasted few proved facts. It was a mixture of symbolism, conjecture and philosophical speculation, too uncertain for rational medicine to build on.

Eight years after the death of Hippocrates, a great change in methods and results was worked at Alexandria. In this famous cosmopolitan center of learning, the home of Theocrates, of Euclid and Archimedes, light was thrown on intimate human structure for the first time. It was made possible by the genius of the Ptolomies. These rulers not only permitted dissection but encouraged it, and in order to remove the odium which had hitherto attached to the desecration of the human temple, used the scalpel themselves occasionally.

The school flourished for three hundred years and lived a thousand. But the conquest by Rome brought Roman customs and traditions. With the fall of the Ptolomies, at about the beginning of the Christian era, dissection again fell into discredit and disuse; and the burning of the library was a blow to the intellectual supremacy of Alexandria from which it never recovered. Anatomy, however, again saw the sun in Galen (200 A. D.). This man, perhaps the most virile figure in the history of medicine, worked with untiring industry, practiced, traveled, wrote and initiated many original methods of experiment. His career was like that of many a Mes-

* Paper read before the Johns Hopkins Hospital Historical Society, October 24, 1910.

siah. Hated by his contemporaries, his teachings and his personality survived his mortal death for many centuries. The activity of his scalpel was limited to animals. His works, which made no mention of human dissection, became weapons of the church. They served as means of curbing the restless inquiry of science, as did the monastic interpretations of the Scriptures in suppressing those wishing to go deeper into the question of man's spiritual welfare. When, in the beginning of the Renaissance, earnest truth seekers, no longer content with the time-worn and erroneous teachings, began to clamor for rational means of renewing and extending anatomical knowledge, the church would answer: "Go to your Galen; he has written truly and all you need to know." Even after human dissections had begun to show how widely Galen's anatomy of animals differed from human anatomy, new prophets, opponents of progress, would arise, who preached against the innovations and upheld the thousand-year-old errors. The cry "back to Galen" was heard as late as the time of Sylvius in 1550.

Galen was a Greek and wrote in his native language. The Arabians were the first to take over and elaborate his writings in their own language. From the Arabic translations they were retranslated into Latin, in which form, garbled and mutilated, they first became accessible to Italian students. They were widely copied in the eleventh and twelfth centuries. Perhaps too wide circulation was the cause of their downfall. At any rate, in the thirteenth or fourteenth century, human anatomy began to be heard of again for the first time since the Alexandrine days. The school of Salerno ordered dissections in the last half of the thirtenth century, and in 1308 the major council of Venice ordered the medical faculty to make a few autopsies every year. But the name above all others associated with the new movement was Mondinus, the little Raimondo, as he was affectionately called, who, as professor or reader of medicine in the University of Bologna, performed his first human dissection in 1315. He could not push his studies far, but his 44-page compendium, which was first copied in MSS., and later printed in many editions, was widely used by the medical schools of Italy and Germany for 300 years. Mondinus made no material advance on Galen's teachings. Many of them he took over bodily without knowing that it was animal and not human anatomy he was teaching.

He heralded the science he could not found. Raising his voice against traditional authority, as he did in his preface, when he said, "non observans stilum altum sed secundum manualem operationum," he stands the John the Baptist of anatomy. The fruits of his example were slow in ripening. The prejudice against mutilation of the human body for any purpose died hard. The rights of the dead were held sacred, as the soul, even of executed criminals, was supposed to be buried with the body. Anatomists, therefore, pursued their studies in the face of viligant opposition, and found themselves becoming midnight marauders.

It was probably more to stop grave robbing than to further the study of anatomy that in 1405 the University of Bologna publicly authorized students of the third year to witness two demonstrations. Both students and masters alike were forbidden to dissect without permission. In 1442 another decree provided the rector of the university with two bodies a year, but no bodies of any one dying nearer than thirty miles of Bologna. So that in the middle of the fifteenth century, when Leonardo da Vinci was born, in the most celebrated university in Europe, it was practically impossible for students to learn how the machine they were to care for was put together. They were not permitted to dissect, they had no books, and such anatomical drawings as were in existence were of no more use than the title page of our *Farmers' Almanac*. This was all changed by Vesalius of Brussels. His treatise on anatomy, *de Fabrica humani corporis*, which Dr. Osler, in the copy of the original edition he presented to the New York Academy of Medicine, calls "the greatest medical work ever printed, the one from which modern medicine dates its beginnings," has for all time crowned Vesalius as the founder of anatomy.

But between the prophecy of Mondinus and the achievement of Vesalius came a man who cannot be overlooked in the history of anatomy, though most of such histories overlook him. A man who inaugurated modern anatomical methods; who studied voraciously, saw keenly and drew with matchless skill what his scalpel brought in sight. This was a man who could give only a small fraction of his time to anatomy, Leonardo da Vinci. Vesalius' book was published in 1543. The great Italian's notes and drawings, made not later than 1510, lay unknown for centuries.

He did his work in Florence and Rome, but probably most of it in Milan. In 1842 he left Florence for the Lombardy capital either to contribute to the gaiety of the court with his famous rhymes and allegories, or to construct the Sforza equestrian statue, or to play on the horse's head-shaped silver lute he had made himself. There, although occupied with the canalization of the rivers and with painting The Last Supper, he found time to carry on dissections. Perhaps he owed his opportunities for the latter to de la Torre, the professor of anatomy at the near-by University of Pavia; perhaps the opportunity came to him by reason of his popularity and charm of manner. "He was so godlike and of such power of persuasion," writes Vasari, "his reason and memory aided him to such a degree, and he could make his views so clear by means of his drawings, that he could convince and confound the most obstinate with his proofs and conclusions." To such a personality all doors fly open and much is forgiven. By virtue of it access to anatomical material was doubtless easier to him than to others, and it is not difficult to believe that many an indulgence was accorded the versatile artist who persisted in pursuing studies in defiance of the sentiments of the times. That he made many dissections is proved by the work he left. Somewhere in the note-books he gives the number as ten. But de Beatis, writing of him when he was an old man living at Amboise under the protection of Francis I, says: "This gentleman has written of anatomy with such wealth of detail, illustrating by his art both limbs and muscles, nerves, veins and ligaments of the inward parts, and of all

that may be demonstrated in the bodies of men and women, in a way that has never been equalled by anyone else. And this we have seen with our own eyes, and he has also told us that he has dissected more than thirty bodies of men and women of different ages."

Leonardo pushed his investigations far beyond the necessities of art; to depict beauty did not satisfy his inquiring mind; he must unravel the very secrets of her being. He sawed the bones lengthwise, to see their internal structure; he sawed the skull in various directions, and was the first to discover the cavities in its walls; he cut through the vertebræ and showed the spinal cord, the link between the brain and the nerves. His restless scalpel exposed the hidden and inaccessible parts and organs of the body. His methods of work were the technical methods of an anatomist, not those of an artist studying anatomy for the benefit of his art. He prepared the vessels for dissection by injection and used a variety of instruments. In the few anatomical sketches left by Raphael and Michael Angelo, the evidences of personal and skilful dissection, unmistakable in all of Leonardo's work, are entirely lacking. They studied anatomy as did the Greeks; Leonardo studied it as does every medical student to-day. He made his drawings of the dissections on loose leaves, on the margins of which he wrote (left-handed) explanations of the drawings, together with notes and suggestions of various kinds. He quotes Galen and Avicenna and proves Mondinus wrong; he tells how many dissections of each part are necessary for proper description, draws diagrams for mannikins arranged with strings, for a proper understanding of the action of the muscles, makes observations on various scientific and philosophical subjects.

Leonardo bequeathed his anatomical note-books to his friend Melzi, who took them with him to Milan. They later had a checkered career, some were lost and some scattered, the largest collection being that at Windsor, which has recently been reproduced in Paris and Turin.

The note-books as we find them are much the same as an anatomist, preparing a book, might draft to-day. The drawings are not arranged in order and the notes are entirely insufficient to serve as a text. But it was Leonardo's intention to write a treatise on anatomy in one hundred and twenty volumes—and the note-books were without doubt the foundation of this project. He prized illustration in everything, and the drawings were the permanent part of the work. This treatise was never finished; perhaps it was never systematically begun. "It is neither avarice nor negligence that has hindered me," he wrote, "but lack of time." So in anatomy, as in almost everything else he did, we are losers in that he did not go further. He left fewer finished works than any other great artist of the Renaissance. But the wonder is that he finished anything. He set himself the highest standards of perfection in execution. And everything he touched aroused in him a seething mass of ideas, speculations and insistent thoughts, which are too often the foes of constructive effort. The world for him was a circus with a hundred rings. He must not only see what was going on in all of them, but must know the details and the causes. He must know for himself. "Who relies on authority for argument," he writes, "uses his memory, not his reason." The dissection of the blood vessels of the scalp stimulated him to inquiry as to the causes of respiration, of the movement of the heart, of vomiting, of how food descends to the stomach and how it is evacuated; how man swallows, why he coughs, yawns and sneezes, why the legs go to sleep, and what makes the sensation of tickling. Any one of these problems could keep a physiologist busy for a life time. But for Leonardo such questions were only a few of those pressing forward for answer.

Flaubert said that Michael Angelo trembled when he came near marble. Leonardo must have trembled in every waking moment, for no circumstance was too trivial to stir the electric excitability of his mind. His execution could no more keep pace with his idea than sound can with light. He responded too freely to stimuli to permit of many finished products. But the high order of his mind is plain from the fact that in spite of his many occupations, everything he did showed the hand of the master craftsman, and every subject was enlightened by his thinking about it. Although he has gained little glory from it, he was easily the first man to acquire an accurate knowledge of descriptive anatomy. In the history of a science the place assigned to those who study it is determined by their influence on the development of the science rather than on what they know themselves. It is doubtful if Leonardo's work was familiar to many of his contemporaries, and there is no evidence that his drawings ever were of use to anatomists of his day or later. A recent contention that Vesalius secured Leonardo's drawings and changed them for his own use is too absurd to receive notice. The merit which is certainly his and the respect in which he is entitled to precedence over Vesalius, is that he used his great talents to break down the barriers which impeded medical progress, and that he inaugurated modern methods of anatomical investigation. A mention may be found in the note-books of a speech to be made to students, probably de la Torre's, in which he urges them to greater zeal in learning from dissection, which even the students were superstitiously afraid of, rather than to rely on authority. He made long-range guns and catapults, and devices for destroying strongholds and for defending them. With the self-confidence which is a part of genius, he submitted to his patrons the most pretentious plans for all military operations. Yet he hated war, calling it a bestial frenzy. And I fancy that he was taking a fling at martial practice when, in his defense of dissection, he compared the morals of the anatomist who reveres human beauty, to the morals of those who aim to destroy it. Throughout he shows the spirit of independence and inquiry, which always means originality of thought, and in those days meant personal courage as well. "Study science first," he notes, "for without it practice is nothing." He urges solitude, to permit the independent working of the mind. He practiced it as far as such a man can. He had no country, no family, and no woman's name was ever associated with his.

All his anatomical work reveals the painstaking thorough-

ness without which as a foundation no science can live. His inquiring mind was not satisfied with description; it must also compare. The bodies of men as opposed to women, the comparative study of different parts (e. g., the foot) in man and animals and birds, the differences of structure at different ages, the protective intentions of nature, as shown by the nerves running along the sides of the fingers, instead of on the front or back, all were studied or noted for study by him. He observed the differences in the blood vessels in youth and in age, and so foreshadowed the recognition of that disease which kills more people over fifty years of age than any other.

Had his accomplishments been less burdensome, had his genius been less universal, had he been permitted to make generally accessible to others what he knew himself, he might easily have shown himself to be as great an anatomist as Vesalius and still have had time to paint the Mona Lisa. Then the honor of founding modern anatomy would have belonged to Italy rather than to Belgium.

# EMBRYOLOGY AND OBSTETRICS IN ANCIENT HEBREW LITERATURE.*

By DAVID I. MACHT, M. D.

The origin of life, the development of the human being, the birth of the babe and the growth of the child have always occupied a prominent place in the literature and religions of all primitive peoples, and in none a more important one than in Judaism, which considers the injunction "be fruitful and multiply" (Gen. I, 28) as the first commandment of the Revelation, and the perpetuation of the race as the sacred duty of mankind, and which brands as crime and moral murder any interference with the normal development and growth of the species from its very incipient stage to the time of its birth. It is therefore not surprising to find that embryology and obstetrics receive more attention in the early Hebrew writings, and more particularly in the Talmud and the Madrashim, than any other medical subject.

References to the earliest stages of embryonic development are found as far back as the Bible. In Psalm CXXXIX, 15-16, we read:

**My being was not concealed from thee, when I was made in secret, when I was embroidered in the lowest parts of the earth. My undeveloped substance did thy eyes see; and in thy book were all of them written down—the days which have been formed, while yet not one of them was here.**

And in Job X, 10-12, we find the following:

**Behold, like milk didst thou pour me out, and like cheese didst thou curdle me. With skin and flesh didst thou clothe me, and with bone and sinews didst thou cover me. Life and kindness didst thou grant me, and thy providence watched over my spirit.**

The general Hebrew name for the product of conception is "peri habbeten" or "fruit of the body." The earliest stage in the development of the embryo is termed "golem," a name borrowed from the passage in the Psalm CXXXIX just quoted, and which literally translated means something "formless and rolled up"—an undeveloped substance. In the further development of the embryo various stages are distinguished by the Hebrew sages and are designated by special names. The first stage begins with the "golem" or undeveloped substance and extends through a period of forty-two days or six weeks. The fœtus at the end of this period is known as "shefir merukkam," or embroidered membrane, clearly referring to the developing ovum with its membranes. The physician Samuel, in the second century (?) studied the embryo at this stage; and we are told that the eyes, nose and mouth can now be distinguished, the whole creature resembling a "grasshopper." In the Tractate Niddah 25 a, we read:

**The wise men learned, what is a "shefir merukkam"? Its eyes are like unto the two dots of a fly and are separate from each other; its two nostrils are like unto the two points of a fly but merge into each other; its mouth is fine like unto a fine hair; and its hands and feet are still unfashioned.**

A second stage is distinguished from the sixth week to the fourth month. The embryo is now called an "ubbar," a passive participle, meaning literally "something borne or carried." It is the ordinary Hebrew word for a "fœtus." So is the mother spoken of as "meubbereth," or one "loaded down"—gravid, and the period of gestation is known as "yemay-ha-ibbur," or the days "of being loaded down"—of gravidity. At this stage, we are told, one can recognize the fingers and toes, the hair and the nails, and also the genitalia (Niddah 25 a). The growth of the hair is an important step in the development. We read "the work is not permanent, until the hair hath cropped out" (Niddah 25 b).

With the fourth month, we come to the third stage in the development. The fœtus is now no longer "like unto a grasshopper," but looks like a human being, and is now spoken of as "welad," a child. This "welad" or child, on reaching the seventh month, is known as "welad shel kaymo," a "viable welad," or a child that can survive. The Hebrew scholars looked upon a seventh-month baby as capable of surviving. In the eighth month, the Aristotelian notion prevailed, that the chances were not so good as in the seventh.

A fully developed fœtus is known as "ben she-kallu chaddoshow," "a child whose months have been completed."

An abortion or miscarriage is known in Hebrew as a "nefel," or something dropped.

In regard to the maturation of the ovum, the ancient Hebrews seem certainly to have recognized that for the develop-

*Read before the Johns Hopkins Hospital Historical Society December 12, 1910.

ment of the primitive germ there must be a union of male and female elements.

"Three partners," we are told, "contribute to the development of man: the father and mother, and the Holy One, blessed be His name. The father soweth the white and the mother soweth the red; God giveth spirit and life" (Niddah 31). Of the male and female elements, it is the nuclei or "kernels," as the scholars put it, that are the essential parts. (Sabin III—Midrash Rabba. 3 M. 14.)

In regard to the order of development of various parts, the general opinion was that the head first developed, then the body, and other parts; but a few maintained that the center of development is the umbilicus, evidently bearing in mind the attachment of the cord with its nutrient vessels.

The position of the fœtus is briefly thus described: "In the first three months, the child is below (that is inside the pelvis); in the second three months it is in the middle (that is between the pubis and umbilicus); and in the last three months it is at the top or at the level of the umbilicus" (Niddah 30). This served well as a rough means of determining the age of the fœtus. The position of the child inside the membranes was regarded as perfectly free, that being the function of the amniotic liquid.

"It floateth like a nut-shell on the waters, and moveth hither and thither at every touch" (Mid. R. 3 M. 14).

The child at full term is graphically described as follows, in a passage which has become classical and is often quoted by Hebrew writers:

> Rabbi Simlai lectured: the babe in its mother's womb is like unto a rolled up scroll, with folded arms it lieth closely pressed together, its elbows resting on its hips, its heels against its buttocks, its head between its knees. Its mouth is closed; its navel open. It eats its mother's food, and sips its mother's drink; but it doth not excrete for fear of hurting. Now when the time hath come, that which is closed is op'ed, and what was open closeth, behold the child is born. (Niddah 30 b.)

When we now turn to obstetrics proper, we are struck by the wealth of anatomical terms. The following is a list of the terms applied to various parts of the organs of generation:

Uterus = rechem.
Mons = kaf tappuach.
Vulva = erwah.
Rima pudendi = beth ha-sesarim (Niddah 66 b).
Vestibulum vaginæ = beth hizon (Niddah 41 b).
Orificium urethræ = lul (Niddah 17 b).
Hymen = be-thulim.
Ostium vaginæ = beth shinnayim.
Vagina = beth teref, beth rechem (Niddah 64 a).
Septum vesico-vaginale = karka prozdor.
Canalis cervicis uteri = mokor (Niddah 41 a).
Cavum uteri = cheder, beth herayon.
Fœtal membranes = shefir.
Placenta = shilyoh.
Ovary and tube = shelil shel bezim (Bezah 7 a).

The diagnosis of pregnancy was made practically by the same signs as now. The signs of pregnancy are divided into two classes: the positive signs and the presumptive signs. The positive signs were regarded as coming from the fœtus itself, the perception of its movements, the palpation of its parts. The chief presumptive signs were the suppression of menstruation, the appearance of colostrum, changes in the size and consistency of the uterus, and various subjective symptoms. A peculiar gait is spoken of, as characteristic of a possible pregnancy. Some obscure passages in the treatise *Niddah* seem to refer to what may be taken as a molar pregnancy or "hydatidiform mole," and there are certainly references to what may be regarded as extra uterine pregnancies.

The signs of former pregnancies, or of labor recently gone through, are cervical and other tears, and the presence of rests of placenta or membranes.

An intact hymen, though a presumptive evidence of virginity, is not regarded as an absolute proof. Cases are described of coitus with unruptured hymen (Chagiga 15 a).

Menstruation plays such an important rôle in the ritual life of the Jews, that a separate paper could be written on the subject. Here we shall merely mention a few salient points.

The age of puberty is by Jewish law set for the male at the completion of his thirteenth year, for the female at the end of her twelfth year. In the Orient, as is well known, menstruation begins at an earlier age than in the Occident. As signs of puberty were regarded the growth of pubic and axillary hair, development of the breasts, elasticity of the mamilla, pigmentation of the areola and various changes about the genitalia.

The type of menstruation was studied especially in regard to a determination of the time of its approach. The Jew is required by law to separate himself from his wife a day before the approach of her menses, and not to approach her until after she has dipped in the ritual bath or "mikewah" seven days after their cessation. Three types of menstruation were distinguished: In the first type, the periods return at certain definite regular intervals of time; in the second type, the return is not so regular as to time, but is preceded by various premonitory symptoms or signs, such as headache, pains in the abdomen, backache, heaviness in the limbs, premenstrual chills and fever, etc.; in the third type are put all the irregular cases.

Infantilism and under-development, with their consequent amenorrhœa and sterility are treated under a special heading called *Ai-lo-nith*. In connection with amenorrhœa and dysmenorrhœa I may mention their treatment by the employment of a reed or a stem, much like the stem-pessary employed by modern gynecologists not so many years ago.

The duration of normal gestation was given by the Talmudists as 271 days, or 9 months of 30 days each. There may, however, be variations, and a pregnancy of 12 months' duration is cited (Niddah 27 a and Jebamoth 80 b). As a mnemonic the length of pregnancy is expressed by the Hebrew word for pregnancy—H E R A Y O N. In Hebrew, as in Latin, numbers are expressed by the letters of the alphabet and the numerical value of the Hebrew word for pregnancy is $5 + 200 + 10 + 6 + 50$ or 271 days.

The course of normal labor seems to have been an easier one among the ancient Hebrews than nowadays. "Ere the midwife cometh in unto them they are delivered" (Exodus I, 19). Severe labor pains were regarded as signs of divine wrath and punishment, and the prophets often employ this figure of speech in their utterances.

Four cases of dystocia or difficult labor are mentioned in the Bible. The first is that of Rebecca giving birth to her twins (Genesis XXV, 24). The second is that of Thamar (Genesis XXXVIII, 27), also giving birth to twins. The third is the birth of Benjamin (Genesis XXXV, 17) in which his mother Rachel succumbed. The fourth is the case of the wife of Phineas (I Samuel, IV, 19) of which we read:

**And his daughter-in-law, the wife of Phineas was with child, near to be delivered; and when she heard the tidings concerning that the ark of God had been taken, and that her father-in-law and her husband were dead, she sank down and gave birth; for her pains came suddenly upon her.**

Women in labor were attended by midwives, called "meyaldoth" or birth helpers, "chachomoth" or wise woman, and "chayoth" or life bringers. Physicians assisting in confinement are not mentioned in the Bible but are referred to in the Talmud.

The birth took place on a special kind of couch or stool—the "mashber." The midwife delivered the child and cut the cord, bathed the infant (Ezekiel XVI, 4), rubbed it with salt and wrapped it in swaddling clothes (Job XXXVIII, 91).

In case of asphyxiation the Talmudists recommend stroking the cord gently towards the infant before cutting it, and in extreme cases trying resuscitation by direct inflation of the infant's lungs (Sabbath, 130 and 150).

Multiple pregnancies are frequently mentioned. Twins were common, and in Egypt we are told the Hebrew women gave birth to sextuplets (Midrash Shemoth, and Rashi Exodus I, 7).

Superfecundation and superfœtation are both mentioned in the Talmud and are of medico-legal importance. The Talmudists held that a superfecundation occurring within forty days after the first conception may lead to normal twins; whereas after forty days one of the twins will thrive at the expense of the other. After the third month superfecundation cannot take place. We read (Berachoth, 60): "From the 40th day until after the 3rd month, one shall pray that there arise no 'sandol' (fœtus papyraceous or compressus); that she may not conceive a second child and so interfere with the development of the first."

With reference to superfœtation the law prohibits the marriage of a widow or a divorced woman who is pregnant until after the birth of the child (Jebamoth, 36 b-42 a; Sota, 26 a).

A word or two as to malformations and monstrosities. Quite a number of malformations and monstrosities are mentioned in the Talmud. We read of a fœtus with a human face and animal body, of a monster with a single eye, of an acephalos, of various malformations of the head, of partial extrusion of viscera, etc. Of special importance are various forms of hemaphrodites. These give rise to legal complications in cases where certain duties are limited to one sex only. A separate chapter in the Mishna under the title Androgynes is devoted to this subject.

Finally, a word in regard to obstetrical operations. Three kinds of operations are mentioned in the Talmud. The first was a destructive one—embryotomy, which consisted in the cutting up of the dead fœtus and extracting it piecemeal. The other two aimed at the saving of both mother and child. One was called "kariyath habbeten" or the cutting open of the abdomen, and was nothing more or less than the classical Caesarian section. The other operation called "yozay dofan" or delivery through the side, also aimed at the saving of both mother and child, but its exact character is a matter of dispute among Hebrew archæologists.

Before concluding, a word as to the Hebrew ideas on heredity and the recently much agitated so-called new but really old subject of eugenics. Freedom of will is, of course, the foundation of the Jewish as well as of all religions. "All is in the hands of God, except the fear of God," is a famous Hebrew saying. Man makes himself! And yet, the Hebrew sages recognize too well the importance of heredity. The sins of the parents are but too often visited on their children and their children's children unto the third and fourth generation, and that both morally and physically, hence a well-known Talmudic saying (Baba Mezia, 75 a): "Seest thou a wise man, whose son is wise, and whose son's sons have been brought up in the ways of wisdom—from their house wisdom shall not depart."

And that is indeed the natural explanation of the numerous Hebrew laws and customs pertaining to marriage and marital relations. The Jewish law does not shrink from the problems of social hygiene, but takes them up and analyzes and discusses them with exactly the same minuteness and exactness as the laws pertaining to the observance of the Sabbath and holidays, the dietary laws, the agrarian laws, the laws pertaining to the giving of charity. The body is not the sordid instrument of sin to be curbed and subjected, stunted and worn out by penitence and castigation; nay, it is the sacred abode of the spirit, and all its normal physiological functions are regarded as wholesome and intended for good. So is the procreative faculty, when subserving its true purpose—the rearing of a sturdy race of servitors to God. With such an end in view it is a sacred duty.

The Torah or the law thus frees us from the fetters of materialism, yet guards against the barrenness of an ascetic life, and consecrating all our activities to an exalted, noble end, uplifts mankind above mere dust. The ordinances concerning menstruation, the rigid laws enjoining periodic separation and purification in married life have all this end in view—to use the means, only as means, not for themselves, but for the furtherance of higher, nobler ends. No wonder, then, one ancient Hebrew sage styles them as ordinances of such momentous, far-reaching importance, compared with which astronomy and geometry are only "after-courses" in the School of Wisdom.

What the results of such a conduct are is not for me here to proclaim.

That, history has shown; that, history still shows; and that, so long as Jew is loyal to his heritage, history will continue to demonstrate.

Kislev, 5671.
December, 1910.

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# ON DISSEMINATED CASEATING TUBERCULOSIS OF THE LIVER.

By William Sydney Thayer, M. D.,
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Focal tuberculosis of the liver is a condition rarely giving rise to recognizable clinical phenomena. Those instances which are detected during life are, for the most part, large, solitary, conglomerate tubercles or tubercular abscesses. Disseminated caseating tuberculosis, while not uncommon, especially in children with intestinal and mesenteric lesions, is not often recognized *intra vitam*.

Rolleston[1] says: "There are very seldom any definite symptoms pointing to the liver."

Brown[2] says: "Complications of the liver have more pathological than clinical importance."

Hale-White[3] describes the condition purely from an anatomical standpoint and says: "This form of tubercular disease does not give rise to any clinical symptoms, as there is no damage to a sufficient number of ducts to cause jaundice."

Ebstein[4] says: "But also in these very rare cases (large conglomerate tubercles), tuberculosis of the liver has a purely anatomical interest."

The recent observation by the writer of an instance of tuberculosis of the liver where, during life, the hepatic changes stood in the foreground of the clinical picture would seem to justify a brief note.

M. B. (Med. No. 22216), a colored woman of 49, was admitted to the hospital on February 11, 1908, complaining of pain in the right lumbar region and in the back. Her family history was unimportant, excepting that her husband had died of tuberculosis 26 years ago. She had had measles in childhood; had been married 28 years; had had two children, one of whom died of tuberculosis. In July, 1902, a hystero-myomectomy was performed for sub-mucous myoma of the uterus, tubo-ovarian abscess and follicular salpingitis.

About five years ago, she had begun to suffer from rather ill-described pain in the left side which had continued. She had had a slight cough with occasional blood-streaked expectoration and increasing dyspnœa on exertion; night sweats for two years, constipation. About two months ago, *there was slight jaundice of the conjunctivæ, lasting about a week.*

On physical examination the thorax was clear, except for a few scattered sibilant râles. The abdomen was full and on deep bimanual palpation there was an indefinite sense of fluctuation in the right flank, although the percussion note was tympanitic, even in the flanks. The border of the liver was not palpable.

| | |
|---|---|
| Blood count: | |
| R. B. C. | 4,136,000 |
| W. B. C. | 6,120 |
| Hb. | 49% |
| Differential count: | |
| Small mononuclears | 7% |
| Large mononuclears | 3 |
| Transitionals | 0.5 |
| Polymorphonuclear neutrophiles | 87 |
| Polymorphonuclear eosinophiles | 0.5 |
| Unclassified | 1 |

Stool: semi-fluid, light yellowish-brown. On standing, the upper third was fluid, the lower two-thirds, a brown and granular material. No parasites or eggs in the sediment; few cholesterin crystals.

The urine was increased in quantity and contained a trace of albumin and a good deal of pus and, considering the resistance in the right flank, it was thought well to catheterize the ureters. The patient, however, refused. An X-ray plate of the right side was taken which was broken in developing. By this time, the suspicion that the resistance in the right side might depend upon a renal mass having passed away, no further X-ray examination was made.

The temperature during the patient's stay in the hospital was irregular, ranging from normal or a point slightly sub-normal, often to 103° F., sometimes to a point above this. It was generally of an hectic character.

The urine continued increased in quantity, the specific gravity ranging from 1.002 to 1.010. Albumin was sometimes absent but often present in a slight trace, and occasional hyaline and granular casts were found in the sediment.

The blood pressure ranged from 120 to 158 mm. Hg. while the patient was in bed and resting.

March 22. Blood count:

| | |
|---|---|
| R. B. C. | 3,636,000 |
| W. B. C. | 6,420 |
| Hb. | 70% |

March 29. Blood count:

| | |
|---|---|
| R. B. C. | 3,776,000 |
| W. B. C. | 6,840 |
| Hb. | 63% |

On April 1, the author noted that the abdomen was held so rigidly that palpation was difficult. There was, however, a dis-

[1] Diseases of the Liver, etc., Phila., N. Y., London, 8°, 1905, 342.
[2] Osler's Modern Medicine, Vol. III, p. 320.
[3] Allbutt's and Rolleston's System of Medicine, Vol. IV, Pt. I, p. 199.
[4] Ebstein-Schwalbe, Handbuch der praktischen Medizin, 2 Aufl., Stuttg., 1905, Bd. II, 434.

tinct resistance at the right costal margin and the sense of an indefinite mass.

The patient was discharged at her own request, on April 4, 1908, with a diagnosis of chronic nephritis and possibly tuberculous peritonitis. The fever still continued.

She returned to the hospital on August 10, 1908 (Med. No. 22989). On this occasion, she had complained for about a month of swelling of the legs, feet, and abdomen, of tenderness in the right upper abdominal quadrant, and of fever and night sweats. There had been a slight cough, but little expectoration; there was constipation. There was slight puffiness of the eyelids, and moderate œdema of the ankles and legs. Slight enlargement of posterior cervical, axillary, epitrochlear and inguinal glands. The lungs showed a few crackling râles at both bases. The abdomen was full, measuring 88 cm. in the umbilical line. It was tender on palpation and had rather a doughy feel; evident movable dulness.

On August 29, Dr. Futcher observed that the liver was distinctly felt 10 cm. below the costal margin in the mamillary line and 8.5 cm. below the xyphoid; 3 cm. above the umbilicus in the median line. There was no special abdominal tenderness and no masses were to be felt. There appeared to be slight impairment on percussion at the right apex with harsh breath sounds and a few medium moist râles at the end of inspiration. The temperature was irregularly continuous and remittent.

The urine was of rather low specific gravity and showed a trace of albumen and hyaline and granular casts. The diagnosis on this occasion was again "Chronic nephritis; tuberculous peritonitis (?); enteroptosis."

The patient returned again on March 12, 1909 (Med. No. 23828). According to her statement, she had remained in fairly good condition until about four or five weeks before admission when she began to complain of diarrhœa, weakness and loss of appetite. There had been a little blood and mucus in the stools and later, some loss of control over the sphincter. There had been no abdominal pain; no cough; no shortness of breath. Two months before she had been troubled for a time by sweating at night. On entrance the temperature was normal but soon rose, remaining irregular and remittent while she was in the hospital, ranging from 99° to 102° F. On physical examination, she was moderately well nourished, but had obviously lost considerable weight. There was slight dulness at both bases with numerous moist crackling râles. The heart was in no way remarkable. The abdomen dome shaped, much distended. The edge of the liver was seen to descend with inspiration, and the edge firm and irregular, was easily felt to the right of the median line. The surface of the liver felt rough though no large masses were to be felt. The flatness extended from the 5th rib to a point 11 cm. below the costal margin in the right mammillary line and 12 cm. below the tip of the xyphoid process. Dulness on the left side shifted with position.

Blood count:

| | |
|---|---|
| R. B. C. | 3,444,000 |
| W. B. C. | 4,600 |
| Hb. | 63% |

The stools, repeatedly examined, were semi-solid and fluid, showing a certain amount of mucus, evidences of occult blood and occasionally a few red corpuscles. Microscopically, there was no excessive amount of fat; no amœbæ were found on careful examination.

DISSEMINATED CASEATING TUBERCULOSIS OF THE LIVER, WITH CAVITY FORMATION, IN AN ADULT.

The blood pressure was rather low—95 to 120 mm. Hg.

The leucocytes were normal in number, even sub-normal, 4500, on the day before death.

An Ewald test meal showed 100 cc. of thin watery fluid which separated into two layers, the upper consisting of a turbid, dirty yellow liquid and the lower of finely-divided food elements. It was acid; total acidity, 18; free hydrochloric acid, absent; lactic acid, absent; test for occult blood, negative. Microscopically, fat droplets were present in considerable numbers; starch granules, epithelial cells and vegetable fibres.

The Wassermann reaction was negative.

The urine apparently rather reduced in quantity, showed a specific gravity of 1.011, a heavy ring of albumen, and numerous hyaline, finely and coarsely granular casts.

On the 18th of March, the writer noted that both apices showed a slight tubular modification of the respiratory murmur, and fine crackling râles were detected, especially above the left clavicle,

as well as a peculiar superficial crackle, which sounded almost pleural in character over the whole left chest. There was little modification on percussion of the bases behind. Numerous fine râles were to be heard at the apices and occasional crackles throughout both backs. Abdomen, large and full. Flanks bulged. The umbilicus protruded. Diastasis of recti. Respiratory movements free. Edge of liver sharp, firm and smooth, but not quite so sharp in the right flank as elsewhere. Upper limit of liver flatness, 6th space in mammillary line. Lower border, 10 cm. below the costal margin in the mammillary line, 9 cm. below xyphoid; notch, well felt. No fluctuation detected.

March 21. The patient had been growing progressively weaker and for three days, the posterior parts of both lungs had been filled with fine, moist râles although there had been no dulness. The heart has been markedly irregular at times. There appeared to be no fluid in the abdominal cavity.

The patient became gradually weaker, the anæmia, more marked.

Blood count:

R. B. C. ..... 3,000,000
Hb. ..... 50%

Numerous fine râles appeared throughout the chest. At 8.30 p. m., she died.

In *summary*, then, the history is that of a colored woman of 19, who, a little over a year before her death, came to the hospital suffering from remittent and intermittent fever and vague abdominal manifestations—tenderness, resistance. Six months later, she returned with a history of diarrhœa of four or five weeks' duration; weakness and general debility. There was irregular fever with morning remissions or intermissions. The liver, which was somewhat prolapsed, was much enlarged and firm and there was a well-marked anæmia of a secondary type. There was, at times, occult blood in the stools which showed considerable mucus. No excess of fat or fatty acids.

The diagnosis of tuberculous peritonitis, made on her previous entry, seemed reasonable when one considered the race of the patient, the fever, and the general abdominal symptoms, the diarrhœa suggesting a tuberculous enteritis, but the hepatic enlargement seemed difficult to account for on the basis of tuberculosis, although the possibility of a fatty cirrhotic liver was considered.

Considering the age of the patient, the degree of anæmia, the progressive enlargement of the liver, its firmness and slight irregularity, one could not but think of the possibility of a neoplasm of uncertain origin. The well known occurrence of fever in association with hepatic neoplasms would not have been against this diagnosis, although no suggestion as to the primary seat of such a growth could be found beyond the possible significance of blood and mucus in the stools.

Another possibility which suggested itself was that the case might be one of amœbic abscess of the liver. The slight fever, the diarrhœa, the jaundice present at one time, although amœbæ had not been found in the stools, and the progressive hepatic enlargement formed a clinical picture not unlike that which is occasionally seen in such cases.

The necropsy was performed on March 22 by Dr. Winternitz (No. 3188).

(Abstract.) Anatomical diagnosis: *Tuberculosis of the mesenteric and retroperitoneal lymph glands with involvement of the receptaculum chyli; chronic adhesive peritonitis; chyliform ascites; tuberculosis of the spine with abscess formation; generalized tuberculosis; extensive tuberculosis of the liver with cavity formation; tuberculosis of the spleen and liver; tuberculous broncho-pneumonia, caseous and gelatinous; fatty degeneration of the liver; chronic fibrous pleurisy; chronic diffuse nephritis; arterio-sclerosis; chronic fibrous myocarditis; thrombosis of ovarian vein.*

The peritoneal cavity contained a considerable amount of chyliform fluid which was extremely milky in appearance. The omentum was definitely plastered to the parietal peritoneum but was not evenly adherent, so that encapsulated areas appeared in which the above-described fluid was found. The intestinal peritoneum was not adherent either to the omentum or to the parietal peritoneum of the anterior surface, so that when the omentum was severed from its attachment, the abdominal contents were easily exposed and the intestines were found to lie almost entirely in the lower half of the abdominal cavity. A large mass was found in the upper portion of the abdominal cavity filling the entire epigastrium and the upper half of the umbilical region as well as the hypogastric region on the right side. This mass which proved to be the liver, was covered over its entire surface by adhesions which were formed by fibrous œdematous union between the peritoneal surface of the organ and the parietal peritoneum. The liver was closely bound to the diaphragm above on both right and left sides. The stomach was bound down by dense adhesions. The mesenteric lymph glands were extremely large and yellowish-grey. On section, they were rather firm and mottled, the greater part of their structure being composed of a rather friable yellowish substance which had a faint green tinge, while throughout one could see other areas which were slightly more translucent and depressed.

There was nothing remarkable in the heart.

The lungs showed a disseminated tuberculosis with larger areas of broncho-pneumonia here and there.

The spleen measured 10 x 6½ x 4½ cm. The capsule was everywhere adherent to the diaphragm and surrounding viscera. On section, the Malpighian corpuscles were indistinct, and smaller opaque yellow tubercles were to be made out.

The stomach, duodenum and pancreas showed nothing of importance.

The liver was considerably enlarged, measuring 30 x 28 x 10 cm. It was flabby, and the surface was covered with nodules varying from 0.5 to 1 cm. in diameter, which were yellowish-grey. On section, the liver was everywhere studded with these nodules, some of which were firm and yellow and caseous; many were, however, cavities showing greenish bile deposits in their centres. Many of these caseous masses were surrounded by thin, translucent, reddish-gray capsules. The remainder of the liver was pale. Lobulation was indistinct. The tissue about the hepatic vein was reddened and the peri-portal veins were everywhere very visible. Small tubercles were also scattered throughout the liver tissue, many surrounded by transparent gelatinous zones.

Kidneys: The right measured 11 x 6½ x 3½ cm. The capsule stripped off with slight difficulty, leaving a rather smooth, pale surface. On section, the kidney was everywhere studded with yellow nodules which, in some spots, were as large as 1 cm. in diameter. Most of these were small, measuring 2 mm. The cortex of the kidney was swollen, averaging 7 mm. The striations for the most part were regular and the parenchyma was extremely pale, showing here and there yellow irregular areas more opaque than the surrounding. The glomeruli were prominent and transparent, pale pink in appearance. The left kidney resembled the right in every respect.

The thoracic duct, which was dissected out carefully was found to be in communication with a mass of glands which lay in the region of the receptaculum chyli.

Nothing remarkable in the bladder.

The glands lying over the spine on the right side from the eighth dorsal to the first and second lumbar, were soft and a puriform fluid escaped from them. There was tuberculous caries of all the vertebræ from the sixth thoracic to the first lumbar. There was no essential curvature of the spine.

Examination of the ascitic fluid showed that, after standing for several hours, it had become more milky in appearance. Specific gravity 1.018. Microscopically, there were large numbers of degenerated peritoneal epithelial cells. In addition, a few small round cells and some fat globules were seen. No tubercle bacilli were found.

The liver, microscopically, showed many large areas of caseation, some involving bile ducts the remains of which could be seen in the necrotic ulcerated centre. The remaining liver tissue showed an extensive fatty degeneration. Around some of the larger tubercles, there was a zone of tuberculous granulation tissue which was rather fibrous showing here and there well-formed tubercles. This doubtless represented the translucent grayish zone which was observed about the large tubercles in gross. There was no definite cirrhosis throughout the remaining portion of the liver, but one found here and there small patches of cellular tissue which were possibly healing tubercles. In these one found no areas of degeneration but a mass of rather well-preserved spindle cells and round cells. Among these numerous blood vessels might be seen. Some of these were evidently the tips of well-formed tubercles. Others of the larger tubercles showed a dense mass of fibrous tissue surrounding a caseous centre. The fibrous tissue, however, was not well preserved and had apparently undergone hyaline degeneration. Tubercles, however, in these areas, were definitely circumscribed and were apparently old processes that are walled off. In other areas, masses of miliary and conglomerate tubercles were to be seen which seemed to proliferate irrespectively of any general position. These did not involve the bile ducts and were not in close relation to any particular portion of the vascular system.

The kidneys showed here and there dense bands of fibrous tissue extending in from the capsule. Here the renal tissue had undergone definite atrophy, the tubules being very much smaller than in the surrounding tissue. Glomeruli might be found in this mass as dense hyaline staining masses. In fact, the glomeruli seemed to show most marked changes. One found in many places, where the uriniferous tubules were apparently not markedly degenerated, that the glomeruli were large, filling up, as a rule, the entire capsule. In some places, there was a slight exudate between the glomerular capsule and the tuft, but this was not often found. There were not very many intermediate stages between glomeruli which appeared normal and those in which there was a dense fibrosis. Where these were to be seen, the thickening seemed to start in the glomerular capsule which proliferated at the expense of the glomerular tuft. The uriniferous tubules throughout stained diffusely red. Their lumina were dilated and contained serous-like material and many casts. Many of the epithelial cells of the tubules showed large vacuoles which filled the entire cells, and smaller vacuoles might be seen near the basement membrane, but not as large as those which have been described. In some places the entire tubules showed this vacuolar degeneration.

To summarize then, we have before us the history of a colored woman, 49 years of age, with a record of rather indefinite abdominal pain of a year's duration and almost continuous remittent or intermittent fever of a moderate degree, with sweating at night and progressive emaciation. Examination of the thorax showed little beyond the appearance toward the end, of rather diffuse fine râles throughout the lungs. During the last eight months of the patient's life there was a steady enlargement of the liver which finally extended to a point 10 cm. below the costal margin in the right mammillary line. It was somewhat tender and very firm, and, on one occasion, slight irregularities of surface were noted. The border which was distinct, seemed a little blunter in the right mammillary line. There was considerable anæmia of a secondary type, but without leucocytosis, a persistent albuminuria and cylindruria without polyuria but with a rather low specific gravity, and, in the end, diarrhœa with mucus and occult blood in the stools.

The progressively enlarging liver, the age of the patient, the anæmia, the fever which after all, is common in hepatic neoplasms, all led us to lean toward this as a possible diagnosis, despite the fact that beyond the diarrhœa with occult blood in the stools no suggestion as to the seat of a primary lesion was to be made out.

The indefinite abdominal pain, tenderness and fever, together with the diarrhœa occurring in a colored woman were strongly suggestive of peritoneal tuberculosis, despite the absence of definite pulmonary signs, but the progressively and apparently great enlargement of the liver did not appear to us to depend upon tuberculosis alone. It was thought that a rolled-up omentum might be adherent to the liver, thus increasing its apparent size, but the sharp border of the liver was against this.

A steadily enlarging liver, with persistent, slight fever, even in the absence of leucocytosis, is by no means unusual in amœbic abscess which occurred to us as a possibility.

Syphilis was ruled out by the absence of a Wassermann reaction and by the fact that anti-luetic treatment had been without result.

The case was, indeed, presented to the class with the main possibilities as to diagnosis set forth in the order named: hepatic neoplasm; amœbic abscess of the liver; peritoneal and intestinal tuberculosis with a rolled-up omentum adherent to the liver in such a manner as to exaggerate its apparent size.

The anatomical appearances, well illustrated in the plate, are rather remarkable in their extent. A disseminated caseating tuberculosis of this degree in the liver of an adult is most unusual. But the feature of the case which is of special importance is that such disseminated caseous tuberculosis of the liver should have given rise to a tumor sufficient to constitute the central figure in the clinical picture.

It is also important to note that for a week at least during the course of this case there was jaundice—a rare manifestation in hepatic tuberculosis.

In conclusion then, it may be emphasized that disseminated caseating tuberculosis of the liver in an adult may be associated clinically on the one hand with appreciable jaundice and on the other with hepatic enlargement sufficient to form the most striking feature of the clinical picture.

# A PEPTID-SPLITTING FERMENT IN THE SALIVA.

By Louis M. Warfield, A. B., M. D.

*(From the Laboratory of the Milwaukee County Hospital.)*

While experimenting with the glycyltryptophan test described by Neubauer and Fischer, some very inconstant results were found which led to the trial of saliva in the hope that an explanation might be found.

The presence of a peptid-splitting enzyme in cancer tissue from the stomach had already been shown by Emerson. He demonstrated its presence by taking macerated cancer tissue, dividing it into two portions, one of which was heated to 80° C. In the unheated portion the digestion of albuminous substances was carried beyond the albumose stage.

In 1909 Neubauer and Fischer utilized this property of cancerous tissue to perfect a test which they thought was of value in the diagnosis of cancer of the stomach. They called attention to four sources of error:

1. Presence of tryptophan in the stomach contents.
2. Presence of peptid-splitting bacteria.
3. Presence of trypsin (pancreatic juice).
4. Presence of blood.

They also affirmed that an HCl content of over 0.36 per cent vitiated the test. They concluded that "1. In the contents of a carcinomatous stomach there is present a ferment which with pepsin splits glycyltryptophan. 2. This ferment is destroyed by an acidity of 0.36 per cent HCl. 3. The presence of this ferment can be used for purposes of diagnosis."

The test is said to depend upon the presence in the carcinomatous tissue in the stomach of a peptid-splitting enzyme which carries protein digestion of peptids to the amino-acid stage. Neubauer and Fischer used the di-peptid glycyltryptophan, a combination of glycocoll and tryptophan. The tryptophan when split off can be readily recognized by a specific color reaction with bromine vapor or bromine water.

Normally pepsin digestion in the stomach is not carried beyond the stage of albumoses and peptones. When the chyme is acted on by the trypsin of the pancreatic secretion, there is further hydrolysis of the peptones into the amino-acids. In the complete digestion of coagulable proteins the stages are: proteins, meta-proteins (commonly called albumoses), proteoses (albumoses), peptones, polypeptids, amino-acids. We are concerned only with the polypeptids. These substances were discovered by Emil Fischer. He succeeded in linking together the amino-acids, the generic formula of which is R—CH—$NH_2$—COOH, with one another. This combination takes place between the carboxyl group of one amino-acid and the amido group of the other with the loss of one molecule of water. The most complex polypeptid yet produced is one containing 15 glycocoll and 3 leucine residues. The name polypeptid is applied to all the group of combined amino-acids. These large molecule peptids are much like the albumoses and peptones in that they do not crystallize, are precipitated by ammonium and zinc sulphate, and give the biuret test.

Tryptophan is indol-α-amino-propionic acid, which in combination with glycocoll forms the di-peptid glycyltryptophan. When this is acted upon by a ferment which is able to split the peptid, it is decomposed into the two amino-acids.

H. Fischer showed that in the normal stomach pepsin splits albumin into peptid chains which react alkaline to litmus. These combine every one with one molecule of HCl, and then react acid to litmus. Normal peptic digestion ceases at this stage. He also found that in stomachs in which there was cancer this chain is broken probably by a ferment. The free HCl vanishes but the total acidity may rise. This is due to the power of the amino-acids to bind the free HCl.

Lyle and Kober studied 21 cases with the glycyltryptophan test.* They conclude that "Results with the test have been satisfactory. A repeated negative reaction is very valuable. When the test is positive the complication of a regurgitation of trypsin must be thoroughly investigated. No deductions ought to be drawn from less than three tests."

Weinstein worked with the test and suggested some modifications. He disagrees with Neubauer and Fischer that when tryptophan is in the fresh contents the specimen should be rejected. He believes that the presence of tryptophan in the recent contents shows the presence of the peptid-splitting enzyme and the glycyltryptophan test is then superfluous. With this I agree. He also thinks that the danger from peptid-splitting bacteria is exaggerated as well as the danger from occult blood. It is difficult to test for bile in the gastric contents. He agrees that a specimen containing macroscopic bile should be discarded. The danger is, of course, that there may be duodenal contents containing trypsin. This is to be guarded against. He prefers bromine water to bromine vapor.

* The test is performed as follows: Ten cubic centimeters of the filtered gastric contents free from bile, removed from forty-five minutes to an hour after an Ewald test breakfast, are placed in a vial with 2 cc. of glycyltryptophan in solution over which is a layer of toluol. This is placed in the thermostat for several hours. Two to 3 cc. are then taken out with a pipette, transferred to a test-tube, acidified with a few drops of 3 per cent acetic acid, and fumes of bromine or a small drop of bromine water added. Care must be taken to pour only a small amount of bromine fumes or to add only a small drop of bromine water. The presence of tryptophan is shown by a rose or reddish violet color. The further addition of bromine vapor or water will, in excess, produce a yellow color. Unless the bromine is added carefully, a little at a time, one might miss a very slight pink reaction. It is also well to allow the tube to stand several minutes, as a very faint reaction often becomes more pronounced on standing.

I have procured the substance from Arthur H. Thomas Company, Philadelphia, Pa. It is expensive, six dollars for one dozen tests. One can now obtain it in bottles containing material enough for twenty-five or fifty tests.

I have also found this a better method. Weinstein prefers a meal of bread, butter, beef and sweetened tea which he removes after 3 to 4 hours and tests directly for tryptophan. If tryptophan is negative he places the filtered contents in the thermostat and tests again after 24 hours. From his work (150 tests) on 63 cases suffering from cancer of the stomach, and other diseases of the stomach, he concludes that the tryptophan test is a valuable sign in the diagnosis of cancer of the stomach. It is a sign in itself. The negative reaction is of more value than the positive. The results are inconstant, he admits. Whether or not it is an early sign of cancer he does not know.

Kuttner and Pulvemacher used silk peptone in their work. It is very much cheaper than glycyltryptophan, and comparative results showed that the tests paralleled each other accurately. The reaction with the silk peptone depends upon the splitting of the substance by the hypothetical cancer ferment into amino-acids, chiefly tyrosin. This is recognized microscopically. Their process is tedious and doubtless will never be used to any great extent in the clinical laboratory. It is academically of interest. They made 163 tests on 92 persons with and without stomach disease. Seven gave definite results, 19 gave variable findings. Vomitus was examined in five cases. Their results were so variable they conclude that the presence of the reaction has no meaning for the diagnosis of cancer of the stomach. For example, in 14 cases clinically cancer of the stomach, the contents reacted five times positively and nine times negatively. In 25 examinations of material removed from the fasting stomach 13 were positive and 12 negative. They call particular attention to the regurgitation of pancreas secretion and the confusion of this with the peptid-splitting enzyme. They think that the test may be of use in the demonstration of the functioning power of the pancreas, particularly after the ingestion of oil.

### Personal Observations.

The first case in which I tried the test with stomach contents and glycyltryptophan reacted positively on two occasions. There was no free HCl in the stomach contents, no evidences of bile. The clinical diagnosis was acute endocarditis. At autopsy the stomach, œsophagus and intestines were absolutely free from tumor. It was thought that in both the tests the influence of pancreatic secretion could be excluded, so my saliva was placed with the glycyltryptophan in the hope that some light might be thrown on the positive tests in a normal stomach. It was a great surprise to find that the saliva split the glycyltryptophan; the test was absolutely positive. No such action of the saliva could be found in literature. Only two enzymes have been described in saliva, ptyalin and maltase. Next my assistant's (C. M. J.) saliva was tested. It reacted negatively. With three separate lots of the test material, procured at different times, my saliva reacted positively. The reaction to litmus is definitely alkaline. Moreover, it was found that by dividing a specimen of my saliva, which had been well centrifugalized, into two parts, after heating one part to 100° C. and not heating the other, the heated portion did not split the glycyltryptophan, while the unheated portion gave a positive reaction. A control with distilled water performed at the same time was negative. How was the negative test with C. M. J.'s saliva to be accounted for? It was found that her saliva was acid to litmus.

It was thought that saliva from one who smokes might account for the positive test. This was shown to be false by the fact that the saliva of my assistant (R. T. G.) who never uses tobacco, gave also a definite positive result. The salivas of the six internes were then tested. Three are smokers, three never use tobacco. All reacted positively and all salivas were alkaline to litmus. Next the salivas of six nurses were tested. These were alkaline and these reacted positively.

The stomach contents of a patient, J. C. (Hosp. No. 8971), who has carcinoma of the stomach, in which there was no free HCl, but total acidity of 52, reacted negatively both to tryptophan in the fresh contents and with the glycyltryptophan on December 31, 1910. Again, on January 13, there was no tryptophan found in the fresh contents. On January 27, with no free HCl and a total acidity of 46, there was a most marked reaction to tryptophan. This was again found on March 3. This patient's saliva did not split glycyltryptophan, but the saliva of another carcinoma case (Hosp. No. 9098), in whose contents there was no free HCl, did split the di-peptid. It was found that the saliva of J. C. was acid, while that of S. was alkaline.

Tests made with stomach contents from a variety of diseases, and from R. T. G.'s and mine after an Ewald test breakfast, showed that when free HCl was present in amount from 0.05 per cent on, the glycyltryptophan was not split. On the contrary, of eleven cases containing no free HCl in the stomach contents all reacted positively but two. Both the negative tests occurred with contents which contained considerable lactic acid. One case (Hosp. No. 8588) was at first thought to be cancer of the stomach, but later was found to be chronic nephritis and arteriosclerosis; the other was J. C., who had acid saliva and total acidity of 52.

One patient, J. S. (Hosp. No. 9140), in whose contents there was no free HCl, gave negative tryptophan and positive glycyltryptophan reactions. Autopsy revealed no stomach tumor of any kind.

Another patient, J. K. (Hosp. No. 8753), with clinical diagnosis of cancer of the stomach, had alkaline stomach contents in which was no tryptophan but which split glycyltryptophan, giving a very positive reaction.

A case furnished by a colleague was rather curious. J. P. B., aged 51, was suspected of having a cancer of the stomach. There was constant absence of free HCl and low total acidity. At the Johns Hopkins Hospital two positive glycyltryptophan tests were obtained, and on these, together with his suspicious symptoms, a laparotomy was advised. In Milwaukee about one month later two tests were negative, but the free HCl was still absent. At operation no evidence of cancer was found. A few enlarged glands which were removed showed only irritative hypertrophy. The saliva in this case has not been tested.

### Discussion of Results.

All who have worked with the test have reported most inconstant and variable results. The test has been found positive in achylia gastrica. This accords with the view here held that it is the swallowed saliva which is responsible for the splitting of the glycyltryptophan. This explains most of the discordant results. An occasional acid saliva would explain an occasional negative test, when it would otherwise be expected to be positive. An examination of the results invariably shows that when the stomach contents are acid, 0.05 per cent plus, the test is negative; when there is no free HCl it may or may not be positive. A high total acidity, combined HCl, as is here shown, accounts for some of the negative results, and the presence of relatively large amounts of lactic acid accounts for some other negative results. Still other negative results in contents showing no free HCl and a low total acidity are accounted for by the acidity of the saliva.

That there is a peptid-splitting enzyme in cancer juice seems to have been shown (Emerson, Neubauer and Fischer). The very fact, however, that cancer of the stomach is so often accompanied by absence of free HCl in the stomach contents is just the condition most favorable for the action of the salivary peptid-splitting enzyme.

From what glands, parotid or sub-maxillary and sublingual, this enzyme is secreted is not at present determined. Whether the splitting is caused by bacteria in the saliva has not been shown yet. Weinstein denies the possibility of bacterial action, and Neubauer and Fischer did not show positively that bacteria could split polypeptids, except after prolonged action for days. At just what temperature the enzyme in the saliva is destroyed has not been accurately determined. Heated to 100° C. it is destroyed.

Care was always taken to centrifugalize the saliva, but it did not appear that this precaution was necessary. Further work is now in progress, but enough has been done to warrant the following conclusions:

1. There is a substance in the saliva, probably an enzyme, which has the power to split glycyltryptophan.
2. This property of the saliva is lost when the saliva is acid or when it is heated to 100° C.
3. Stomach contents containing no free HCl may split glycyltryptophan.
4. Stomach contents which have a high combined acidity or which contain a relatively large amount of lactic acid fail to split the di-peptid.
5. In view of these facts the glycyltryptophan test is of no value in the diagnosis of cancer of the stomach.

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# THE RELATIONSHIP BETWEEN THE NORMAL AND PATHOLOGICAL THYROID GLAND OF FISH.

By J. F. Gudernatsch.

*(From the Department of Anatomy, Cornell University Medical College, New York City.)*

Recent investigations of the thyroid gland of Teleosts have revealed a great many facts that may be of value to the comparative pathologist. The thyroid gland of these fish attracts at present a good deal of attention in cancer research, since it is often liable to cancerous degeneration, especially in artificially reared trout and salmon.

The normal anatomy of the gland was briefly described in a paper read before the meeting of the American Association of Cancer Research, November 27, 1909. * It was especially emphasized that one of the most striking features of the thyroid in bony fish is the absence of a connective tissue capsule, such as exists in other vertebrates. Later this fact was again pointed out by Marine and Lenhart. It will readily be seen that the absence of a capsule makes it rather difficult to define the normal extension of the gland. It would perhaps be better not to use the term "thyroid gland" at all in this group of animals, since physiologically isopotent units (follicles) are not so arranged as to form a closed organ, but are distributed over a wide area (Fig. 2 and Plate 1). This distribution varies not only with the species, but also with the individual, and is dependent entirely on mechanical influences, mainly pressure from the sides of the surrounding tissues,

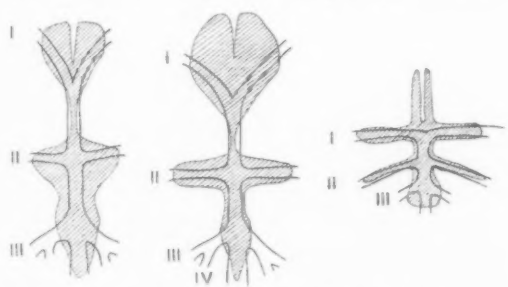


Fig. 1.—These diagrammatic drawings show the expansion of the thyroid gland in the three species: Oncorhynchus, Salvelinus and Opsanus. *I*, aortic bifurcation; *II*, *III* and *IV*, the second, third and fourth branchial arteries.

* An extensive analysis of the normal conditions of the Teleost thyroid will be found in Jour. of Morphology, V. 21, Suppl., 1911.

and pull enacted by the growing connective tissue fibers and blood and lymph vessels. The latter force works chiefly in the early development of the gland, when thyroid cells are carried off from the main point of growth to distant regions, where they form new centers of multiplication.

The thyroid gland develops around the stem of the ventral aorta (Fig. 1), in many species the main bulk lying between the branches to the first and second gill arches. This locality is filled with connective tissue and fat, and is enclosed dorsally by cartilages or bones and ventrally by muscles. Thus the region available for the thyroid tissue is rather limited, and therefore the follicles tend to fill every space that is offered by the surrounding structures. Not uncommonly follicles are found far from the center of thyroid development, invading muscles (Plate 1, *C*) or creeping into the crevices which exist between the osseous lamellæ of the bones in this region (Fig. 2 and Plate 1, *A*).

The thyroid gland of the Teleosts is thus a rather indefinite organ in its shape, having the tendency to lose its unity and break into numerous small parts. In some species, the trout and others, this tendency manifests itself most strikingly, so that thyroid follicles are found even far out in the gill arches along the gill filaments (Plate 1, *D*).

The spreading apart of the thyroid follicles over a wide area and the invasion of neighboring tissues are a normal feature and of no pathological significance. By such an invasion the surrounding structures are not destroyed. Often the term "invasion" is even incorrect. Thus Marine and Lenhart's statement that the normal follicles invade the bones is not appropriate, since they do not invade true bone or cartilage tissue, but merely the spaces that are present *between* the osseous or cartilaginous lamellæ (Fig. 2 and Plate 1, *A*). In their paper Fig. 6 demonstrates this fact definitely, although it is supposed to show a true invasion. On the other

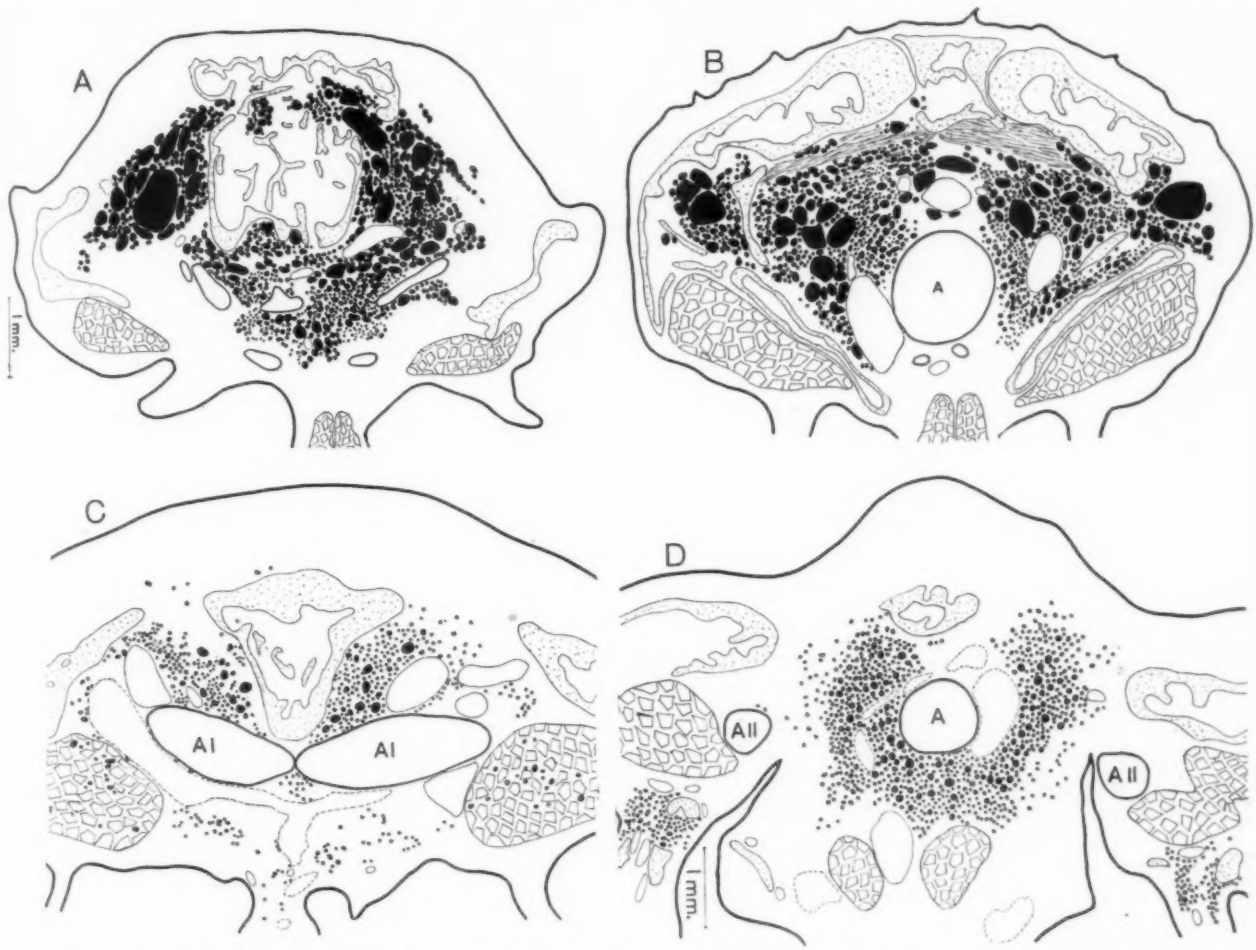


PLATE I.—*A* and *B*, sections through the thyroid gland of Sarda. *A*, in the region of greatest extension anterior to the aortic bifurcation; *B*, near the second branchial arteries, the region of greatest extension. *C* and *D*, sections through the thyroid gland of Salvelinus. *C*, in the aortic bifurcation; *D*, near the second branchial arteries.

(Thyroid follicles in all figures shown in solid black. Transverse muscles lined. Longitudinal muscles in polygons. Skeletal parts stippled. Arteries in heavy lines. Veins in light lines. Lymph sinuses in broken lines. *A*, ventral aorta, *AI* and *AII*, branchial arteries.)

hand, Gaylord was able to show specimens in which thyroid tissue, belonging to a diseased gland, had actually invaded or infiltrated true cartilaginous tissue. The latter invasion, of course, is never seen in the anatomy of the normal gland, but is a strictly pathological feature. Whether or not it is due to a cancerous growth of the gland, may still be an open question. Strong evidence seems, however, to point in that direction.

Should the so-called thyroid carcinoma of brook trout be a cancerous growth and not a mere hyperplasia, as Marine and Lenhart believe, then the question of metastasis again demands the pathologist to keep in mind the lack of a capsule. Certainly no detached nodules in or around the gill region can safely be called secondary tumors, since such misplaced structures in all probability are merely parts of the primarily diseased gland. However, tumors on the tip of the jaw or around

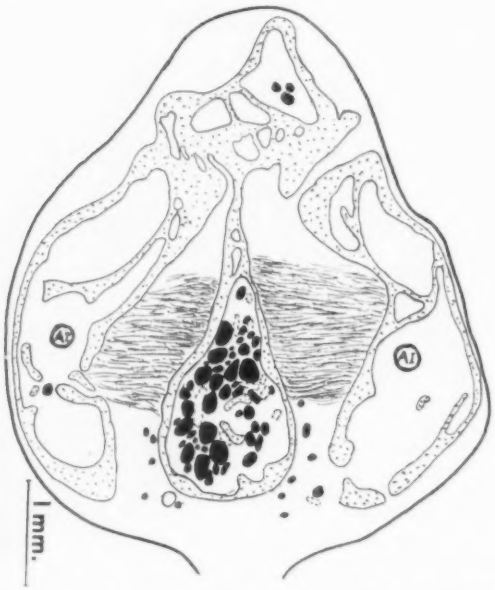


FIG. 2.—Section through the thyroid gland of Brevoortia, anterior to the aortic bifurcation. *AI*, first branchial arteries.

the anus, as Gaylord has found them, can hardly be explained as due to normally misplaced thyroid particles. Whether they are true secondary growths or simply implantations, further experimental investigations may show.

Histologically the thyroid gland of the Teleosts offers a great many interesting peculiarities. The size of the follicles varies between very wide limits. Aside from the fact that in young embryos it is naturally very small, the size of follicles cannot be taken as a reliable indication of the age of the fish. It seems much more probable that it is a sign of the age of the individual follicle.

The follicular epithelium varies from an almost flat to a very high, columnar type. It is different in each individual and may somewhat depend on the age and the physiological condition of the animal. Yet the type of the epithelium is not always uniform in all the follicles, sometimes very marked differences are found (Fig. 3). Even in the individual follicle the height of the epithelium may vary, probably due to different pressure from outside. It was now and then observed, that in oblong follicles the epithelium on the two longer sides would be lower than on the shorter ones.

The colloid material is sometimes present in all the follicles, in other glands it may appear in some only, in still others it may be entirely lacking. It, again, is no definite sign of the age of the animal, although it may be somewhat dependent on the age of the fish, its sex (egg-carrying females, for instance) and other inherent factors that need further investigation. The colloid certainly is a sign of the physiological state of the individual follicle, yet we do not understand it well enough to interpret our observations in a definite manner. There can be no doubt that all the follicles of a gland are not in the same state of physiological activity. Otherwise it cannot be explained why (Hürthle's) colloid-forming cells appear in some follicles only, sometimes in a

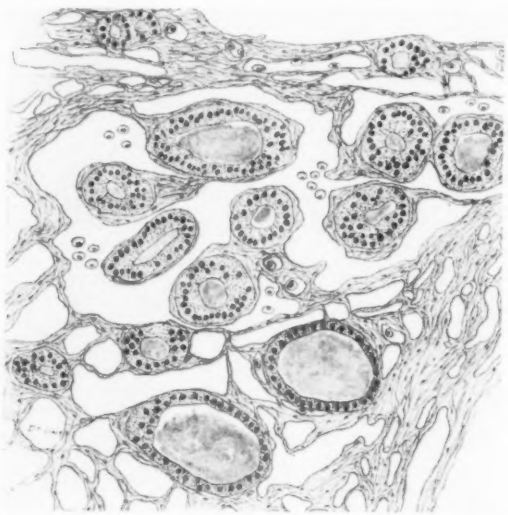

FIG. 3.—Section through the thyroid gland of Salvelinus fontinalis. Note the different heights of the follicular epithelium. Dia. 1:300.

group of neighboring follicles, so that we can easily distinguish "colloid zones" from non-colloid-forming parts of the gland.

In interpreting their results after iodin treatment of the thyroid gland of the pike Marine and Lenhart lay great stress on the histological appearance of the treated and not treated glands. Yet from the above discussion it seems obvious that the anatomy of the gland as well as its histology, as far as the type of epithelium and the colloid formation are concerned, makes it rather difficult for the microscopist to distinguish a normal from a hyperplastic, and the latter in turn from a "reverted" thyroid gland in these fish.

The presence or absence of the colloid material has no significance whatsoever. If all glands, the follicles of which spread out far from the main bulk even into the gill region, are highly hyperplastic, then, according to Marine and Len-

hart, the colloid material should be nearly or entirely absent in them. Yet it is present throughout the gland.

The type of the epithelium is also a perfectly unreliable guide in regarding a gland as hyperplastic. When, of course, the epithelium shows marked foldings and protuberances into the lumen, the hyperplastic condition is evident.

Further studies on the carcinoma of the fish thyroid will have to take into account the peculiar anatomy and histology of this organ in the Teleosts. Many conditions which might be regarded as pathological may prove to be normal as soon as our knowledge of all the factors involved is sufficiently broadened.

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# TUBERCULAR BURSITIS.

## TWO UNUSUAL CASES.

By SYDNEY M. CONE, A. B., M. D., Baltimore.

There is a great deal being written to-day about diseases of the bursæ. The literature is full of references to acute and chronic inflammation of these sacs, and here and there may be found a description of a tumor of a bursa; syphilis is described involving it as is tuberculosis. The study of the anatomy and development, the pathology and clinical conditions involved in these diseases leaves little more to be added.

In Codman's report we get not only an exhaustive description of the anatomy and development of the subdeltoid bursa, but learn of the changes that may take place in this little known sac. He describes conditions that may be confused with bursal involvement, and the average medical man will be surprised to learn the seriousness of disease of this much overlooked anatomical structure. He will recall many cases of so-called sprain, rheumatism, tuberculosis, neuritis and other conditions about the joints which, in the light of recent investigations by conservative and scientific investigators, are doubtless bursal disease.

Many odd cases in the Johns Hopkins Dispensary called painful shoulders, referred to by Dr. Finney (Johns Hopkins Hosp. Bull., 1894) are doubtless cases of subdeltoid bursitis.

Many cases of inflammation of the prepatellar and olecranon bursæ have been recorded, but little thought has been given to the possibility of similar involvement of many similar sacs throughout the body.

Bursal disease is a common cause of painful conditions about the heel and sole of the foot—many cases having been described in the orthopedic journals. Lund describes three cases of inflammation of the iliopsoas bursa, and Cullen gives the history and an excellent pathological description of a cyst in the pelvis which developed from the iliopsoas bursa which continued its connection with the hip joint.

The numerous bursæ about the hip joint have been the seat of pathological changes as described by Da Costa, Nicaise, Brackett, Thurston, Wietung, Zuelzer, Ducroux and others. Teale gives a case of suppuration of the bursa over the great trochanter and its immitation of hip disease. Brackett, in his article on "Gluteal Bursitis," likewise refers to the simulation of hip joint tuberculosis.

The greatest amount of literature on this subject takes the subdeltoid bursa as the text. Codman, Baer, Painter, Duplay, Bousquet and Kaumheimer cover this field quite thoroughly.

Acute infections due to various micro-organisms are recorded. Kaumheimer describes a purulent pneumococcus involvement following pneumonia. One of Duplay's cases was due to a streptococcus following erysipelas of the hand. Wegner, Heubner and others refer to a mixed infection following syphilis, and Kreuter describes a case of metastatic infection of the subdeltoid bursa from an original osteomyelitis of the femur. The gonococcus and influenza bacillus have likewise played their part in causing acute inflammation of bursæ.

The older writers referred in the main to syphilitic disease as evident in secondary and tertiary lesions. Churchman, writing on this subject, finds twenty-eight such cases in the literature describing them under the name "Luetic Bursopathy of Verneuil." Schuchardt who describes tubercular and syphilitic disease of bursæ in trying to solve the question of fibrin formation or fibrinoid degeneration of rice bodies in hygromas of tendons and bursæ, aids us materially in viewing clearly tubercular disease of bursæ.

Acrel in 1779 first described the "Ganglion Crepitans Acrelii" containing rice bodies which were doubtless tubercular. Dupuytren and Cruveillier likewise described cysts at bursal points containing rice bodies. Dupuytren called them hydatidiform cysts and thought the bodies parasites. Virchow noted them in hygromas and took them for fibrin, but confessed that he afterwards learned they were organized excrescences increasing in size by later gradual fibrin deposits. Although there is a close relationship in anatomy and pathology, between tendon sheaths and bursæ, one must distinguish the cases of tubercular tendo-vaginitis from those of tubercular bursæ for clinical purposes.

There is no doubt that the pathological descriptions of Acrel, Dupuytren and Cruveillier, and the works of Virchow,

Neumann, Riese and others, on fibrin and fibrinoid bodies in tendon-sheath hygromas, apply to the bodies as found in bursal sacs. It is unfortunate that in describing or referring to their cases of tubercular bursæ Brackett, Thurston, Gillette, Ketch, Gibney and Sayre did not give more complete descriptions of their pathology. In none of these cases was reference made to fibrin or fibrinoid bodies. Brackett gave a short clinical history with seven cases of "gluteal bursitis" which he thought were tubercular. In Thurston's case we note that there was calcareous and cheesy material in the contents; but as he simply drained and did not examine the walls of the sac, there is left much of value to be inferred. And as Painter described yellow, cheesy, granular contents and villous enlargements in non-tubercular bursæ, and Cullen described bone, calcareous and cartilaginous masses in a simple cystic bursa, and Kreuter gives a simple subdeltoid bursitis containing cholesterin, fat and brownish fluid, we must still be in some doubt as to the true tubercular character of some of the cases (few as they are) described under the head of "tubercular bursæ."

So far as I can find, the cases of Schuchardt, Riese, Nicaise, Poulet and Vaillard are the only ones which present well-described tubercular bursæ containing rice bodies. They alone described bursal hygromas containing rice bodies. Most of the discussion as to the pathological histology and tubercle bacillus contents of the melon seed or rice bodies in hygromas has been based on work done on those found in connection with tendon-sheaths and joints.

"Tuberculosis of Bursæ" has certainly been not infrequently described, but not as a rule, in connection with rice body contents.

In some of the cases of tubercular bursitis which have been described there has been doubt as to whether the joint or bursa was the primary seat of the disease. In one of our two cases this relationship is a doubtful point. As a rule the question has not been settled. In a few cases—as for example, Thurston's and Brackett's—the rapid healing and disappearance of disease after relieving the bursa of its fluid and draining proves the joint uninvolved.

In some cases it has been demonstrated at operation that there was no connection between bursa and joint by which the disease could have extended from one to the other.

In other cases (Sayre, Lund, Cullen, Gibney and Brackett) a definite communication was demonstrated. From symptoms alone one cannot determine whether the joints are involved. The bursa when inflamed frequently leads one to think it a joint disease. Brackett, speaking of ordinary gluteal bursitis, says it resembles hip disease in its early stages. The X-ray is helpful, as, for example, in one of our cases where there was no evidence of bone lesion connected with the joint. The cloudiness about the joint was evidently due to the bursal contents covering the joint. At operation no communication was seen and incision into the joint showed no involvement. In our second case both joint and bursa were involved at the time of operation, the bursa being a dense mass of fibrous tissue and caseous tubercular material, while the joint showed villous masses of fibrous tissue with lymphoid tubercles in them. Which was the primary seat it is difficult to say. The fact that the disease of the bursa from pathological as well as from clinical data appeared older, would make us believe it to be the original focus of the tuberculosis.

Churchman tabulating twenty-eight cases of "Luetic Bursopathy of Verneuil," says that in only one case was the neighboring joint involved.

Several interesting pathological questions are brought to mind in studying these cases of tuberculosis of bursæ and the literature deals with each one in more or less detail.

The question which has been most actively studied is about the formation of rice bodies. In dealing with this question it has been assumed, and we think quite justly, that the so-called rice bodies including all fibrin or fibrinoid bodies of whatever shape or size, and wherever found, whether in bursæ, tendon-sheaths or joints, belong to the same class. In his work on the subject, Riese includes studies on rice bodies found in all three locations. He goes quite extensively into the history of the knowledge of rice bodies, referring to Acrel as the first, in 1778, to describe real rice bodies; he classified them as atheromatous, comparing them with boiled sago or corn grains. Dupuytren, Brodie, Rokitansky, Virchow, Meckel, von Recklinghausen and others held original views about them.

Cruveillier (1816) and Dupuytren (1839) dealt with them as hydatid cysts. Brodie (1821) considered them coagulated lymph. Rokitansky said they formed from abnormal fluid in the cysts. Virchow first recognized their relation to fibrin in 1846 and originally thought them coagulated masses—clots gradually formed. In 1856 he referred to them as coming from changed intercellular substance by the process of degeneration. Now no one disputes their relation to fibrin. The greater amount of discussion is based on the question—are the fibrin deposits from fluid, or are they changed cellular material, due to a coagulation necrosis, or degeneration of cells? This side of the subject takes up much of Riese's, Nicaise's and Schuchardt's work.

Konig (1884) was the first to recognize their tubercular origin, recognizing at the same time that they were formed by a coagulation necrosis of albuminous material.

Schuchardt acknowledges that rice body hygromas are always tubercular, but does not think that rice bodies wherever found are always due to tubercle bacilli. It would take us too far to describe the pathology of rice bodies in relation to the various structures where they have been found. Some of the most useful literature describing these fibrinoid objects has been found in connection with ganglia and tubercular arthritis. Evans (Am. J. Med. Sc., 1892) wrote the most comprehensive work on the subject in English. Nicaise, Paulet and Vaillard include in their work a combined study of tuberculosis of bursæ and tendons with rice body formations.

Schuchardt made a special study of fibrinoid degeneration of connective tissue under the heading "Tuberculosis and Syphilis of Tendon-sheaths."

We gather from the most enlightened and comprehensive recent writings that the rice bodies are to be considered as

fibrin deposits formed either from coagulable fluid in tubercular sacs, or from a coagulation necrosis of cells or intercellular substance in tubercular tissues.

There is considerable discussion of their mode of formation and relation to the tubercular walls of the containing sac whether bursa, tendon-sheath or joint. After all, we may go back to Virchow's expression of opinion to get at the basis of their formation. This includes some of the best that all express. He says, "I had taken them for clots of fibrin laid down concentrically, but I have since learned that they are organized excrescences. It is possible that they increase in size by gradual fibrin deposits." He thus includes both of the methods of formation, that of an organized material undergoing coagulation necrosis,—the method Schuchardt defends and the credit for proving which he gives to Neumann (Arch. f. mikr. Anat., XVIII, 1880)—and the method of concentric deposition of fibrin as advocated by Nicaise.

These bodies have been described by Nicaise as amorphous and slightly granular bodies with no enveloping membrane. "They are stratified and here and there between the layers are little lacunæ containing bloody granules, refringent bodies like fat or round like leucocytes, but not taking the stain. There may be some remains of connective tissue stained faintly red. . . . . Perfect or incomplete tubercles are found in the sac walls—the very surface shows a varied structure sometimes of connective tissue fibres, again, a thin strip of reddish-brown homogeneous vitreous material under which may be seen a hemorrhagic film and a thin band staining like the rice bodies. . . . . In the center of these one sees vestiges of necrotic cells; at times there is seen a layer of elongated cells, vaguely cylindrical, ending in a mass of granulation tissue beneath. On a level with the surface project some little irregular masses, slightly adherent like beginning rice bodies made of layers doubled on themselves."

Riese says: "The smaller bodies are a meshwork of flaky homogeneous masses running together to form bands taking the fibrin stain. The center is deepest stained. Between single bands there may be seen irregular gaps in which are finely granular masses containing very few leucocytes. At the periphery are some large nuclei (without perceptible protoplasm) and few leucocytes. In some there are seen masses of red blood cells stuck together by fine granules, but no fibrin is present in these."

The presence of tubercle bacilli was shown in the fibrin bodies by all investigators either by staining them or inoculating guinea pigs.

The walls of the containing sac were invariably infiltrated with round, epitheloid and giant cells in varying proportion, and as single or conglomerate or caseated tubercles. There was a varying amount of adherence to surrounding structures. The greatest attention has been paid to the inner lining—this coat showing either caseation or degeneration in lesser degree of cellular material growing as villi.

It was with the desire to decide whether or not these villi were the origin of the rice bodies that Riese, Nicaise, Poulet and Vaillard, and Schuchardt did such extensive work.

Riese and Schuchardt laid more stress on the coagulation necrosis of this surface material as being the point of origin of the rice bodies, while Nicaise seemed to find fibrin deposits or curled masses to account for their origin.

Reinhardt deals with an entirely different condition of the bursa caused by tuberculosis—"Primary Sclerosing Tuberculosis." It is analogous to the second case I describe.

He noticed about the trochanteric bursæ a number of fibrous nodules. These were thick and of a grayish color going suddenly over into the surrounding tissue. In them were seen little pinkish-gray areas 1 mm. in size. Microscopically they were dense connective tissue infiltrated by small round cells in areas; some fat was included. The connective tissue fibers were thick, interwoven and parallel. Some cells were elongated, some were more protoplasmic and stellate. The intima of the vessels was thickened and typical tubercles were seen near the perivascular infiltrated parts—consisting of giant cells of Langhans type, surrounded by epitheloid and round cells and leucocytes. Some areas were composed almost entirely of giant cells; some nodes showed central necrosis with broken down leucocytes or granular material.

Reinhardt records six cases like this and refers to their resemblance to fibroma and syphilitic gummata. The cases are in every respect like that of the prepatellar bursa described by me.

It is interesting to note in this place the varying form in which tuberculosis affects tissues. Reinhardt refers to the French authors, Poncet more especially, who wrote about "sclerosing tuberculosis due to a fibrous diathesis following finished tubercular processes." Ducroux, one of Poncet's followers, described a series of cases of tuberculosis of a "serous bursa" between the scapula and the chest wall which occasioned crepitus and friction sounds. "It is due to a chronic inflammation of a loose cellular tissue (a kind of spread out serous bursa)." He incidentally referred to Poncet's ideas about tuberculous rheumatism where specific anatomic lesions were wanting. He says, "This same condition occurred in tendons, bursæ, cellular organs and all tissues. Some of these cases might be called tubercular rheumatism."

We see in the two cases presented by me typical examples of the two types of tubercular involvement of bursæ described by these writers. They agree with them in all particulars, both in symptoms and pathology.

The condition develops insidiously, sometimes requiring years before the patient considers it worth while to consult a surgeon. He may think it due to rheumatism or a sprain. Examination of the part does not necessarily elicit pain or considerable disability of the part involved until late. There is usually muscle atrophy more or less limited to the parts immediately surrounding the involved bursa; in my cases the deltoid muscle alone showed atrophy.

X-ray examination showed nothing specific by which a diagnosis could be made in either case.

In one case the crepitus of masses in the bulging area was significant, whereas in the case of the prepatellar bursa there was nothing but a dense circumscribed projecting mass which

could have been gummatous quite as well. It is interesting to note that in the shoulder case there was no involvement of the joint, whereas in the prepatellar involvement there were tubercular villi of long standing in the knee joint.

The main interest centers about the pathology of the cases—one representing the type of rice-body formation in a tubercular bursa, the other a chronic sclerosing tubercular process.

Case I.—J. F., white male, age 22 years. Admitted to the Hebrew Hospital, July 26, 1909, complaining of pain at and loss of function of the right shoulder.

*Family History.*—Good. No tuberculosis.

*Past History.*—He has always been strong and healthy, never sick in bed in his life.

*Present Illness.*—For about three years his right shoulder has been stiff on getting up in the morning; this would wear off after he had worked awhile. For the past three months it has been painful all the time. He cannot work because of the pain. It is more painful on motion. The pain is sharp, lancinating in character.

*Physical examination* shows fullness of the right shoulder, more apparent over the coracoid process, and crepitus under palpating fingers in front of the joint. Tenderness localized at the acromion process. He cannot raise the arm nor place it behind him because of pain. His grip is as strong with the right as with the left hand. He allows the arm to hang helpless by his side.

Measurements:

| | |
|---|---|
| Right axilla over acromion | 15½ in. |
| Left axilla over acromion | 16 in. |
| Right biceps | 10 in. |
| Left biceps | 10½ in. |
| Right biceps (above) | 9¾ in. |
| Left biceps (above) | 10¼ in. |

July 29. X-ray shows rarefication over the tuberosity of the humerus and slight roughening here as well as at the upper portion of the glenoid fossa. Joint, negative.

July 29. Two milligrams tuberculin were injected subcutaneously, to which he reacted locally, focally and generally. There was swelling, tenderness and redness at sight of injection, pain the following day at the shoulder, and the temperature rose from 97.3° F. to 100° F.

Aug. 2. Operation, under ether: Incision from the acromion process outwards and downwards toward the deltoid insertion three inches long, through the deltoid muscle exposing a thick gray sac; this was easily exposed by blunt dissection anteriorly, but owing to adhesions about the tuberosity of the humerus and difficulty in getting the sac away above the coraco-acromial ligament, the sac was incised, when about 400 multifacetted bodies flattened against one another shot out, together with a thin serous fluid. The sac was now removed without difficulty. An incision was made into the joint at the point of greatest adhesion near the greater tuberosity; the joint was normal. The bone too was normal. The cartilaginous tip of the acromion process appearing translucent and soft, a longitudinal section 1.5 cm. long, was removed for examination. The muscle was sewed with a continuous cat-gut suture. Skin closed with continuous subcutaneous silkworm gut suture. A small wick of iodoform introduced; arm bandaged with Velpeau bandage, with a Gillette pad in the axilla.

Aug. 5. First dressing: Iodoform drain removed, wound dry.

Aug. 19. Patient discharged healed *per primam*.

Sept. 8. Patient readmitted, complaining of pain in his shoulder and a small sinus at the region of the acromion process in the line of incision. An X-ray was taken showing the joint negative—osteophytes are evident about the tuberosity of the humerus where an exploratory operation was done at the time of excising the bursa.

The sinus was treated and closed by September 22. He was discharged September 29 with arm in a sling, Gillette pad in axilla.

The patient was treated off and on for fistulæ which formed about the site of the old operation—one forming posterior to the axilla at the apex of the axillary fold. One formed about the junction of the outer and middle third of the clavicle and one inch below it.

Jan. 24, 1910. While treating the sinuses it was noted that he was coughing and an examination for admission to the Jewish Consumptive Home at Reisterstown showed both apices of the lungs to be involved by tuberculosis. He was sent to the home, where I treated him. He was discharged much improved both as regards his lungs and shoulder. He then went to the country and returned in excellent condition.

Oct. 15, 1910. The sinuses are all closed and the patient who has been using the arm off and on since the operation is now constantly using it. The muscles over the joint have not recovered their tone, but the biceps reacts strongly and is not atrophied.

### Pathological Description of the Case.

The sac containing about 400 grayish-white translucent bodies pressed into multiform shapes resembling in size and shape facetted gall stones, was 11 x 6 x 3 cm. in size, elongated oval in shape. Its wall varied in thickness from 3 mm. to 1 5/10 cm., was firm, homogeneous and gray in color with pinkish areas throughout. At its uppermost end under the acromion process it was a dense fibrous tongue of tissue wedged against the softened cartilaginous tip of the acromion process. Its inner lining was softer and of yellowish color, but smooth for the greater part, trabeculated here and there. The rice bodies stuck firmly in this meshwork. There were some few nodular areas, but no villous processes could be picked off until deeper in the walls of the sac. These nodular areas resembled the material of the rice bodies but were softer. The sac was in layers 2 mm. thick at the outermost shell. The outermost walls were hemorrhagic and shreddy, but dense connective tissue existed where the sac was adherent. The contents consisted of round, oval and facetted bodies varying from to 2 to 8 mm. in size; these were so densely packed that some force was required to separate numbers of them. Many of them fitted snugly depressions and pockets among the trabeculæ in parts of the wall of the sac. They were of a grayish-white color and translucent appearance—not very firm, the center being darker and softer than the periphery. They consisted of layers, the outermost being 2 mm. thick. These could be picked apart, easily cut, so that free hand sections were made for staining for fibrin and tubercle bacilli while yet fresh. There were some elongated shreds resembling the above but softer and more shreddy and darker, resembling blood-stained fibrin. Microscopic examination showed the bodies to be a granular loculated material staining with Weigert's fibrin stain and showing flakes, granules and strands. Traces of nuclei were faintly stained here and there. Tubercle bacilli were found with the Ziehl-Neelsen's stain.

In acetic acid this material swelled showing a fenestrated

CASE I.—BEFORE OPERATION.

CASE II.

CASE II.—TUBERCULAR BURSITIS.

CASE I.—AFTER OPERATION.

TUBERCULAR BURSA WITH FIBRIN BODIES.

appearance. The bone from the tuberosity of the humerus was rather porous but showed no cellular infiltration or hemorrhage. The bone cells and lacunæ showed no pathological alteration.

The softened tip of the acromion process showed mucoid degeneration of the cartilage cells, some of them appearing in stellate forms.

Sections were made from many portions of the sac through its entire thickness. It showed typical tuberculosis and of varying histological structure, dense fibrous tissue containing areas of small round cells, small round cells and epithelioid cells, sometimes giant cells, sometimes caseation with these or areas where caseation was the only microscopic change seen. In places there were single and conglomerate tubercles. Many vessels were occluded by two or three giant cells with few epithelioid cells, some small round cells about them. Frequently a gradation could be traced from the dense fibrous outer structure to the cellular, infiltrated, softer inner wall, to degenerated non-staining cells and lastly to a lining of granular or flaky non-staining material, with apparent lines of cleavage traversing it in some sections.

Where adhesions held the sac to surrounding parts near the tuberosity of the humerus the outermost tissue was very much congested and hemorrhagic, but was fairly well distinguished from the sac by the latter's dense structure, and its containing rounded spaces lined by tubercular giant cells. There were no infiltrating round cells or giant cells in this adherent wall.

CASE II.—**The second case is one where there was associated tuberculosis of the neighboring joint.**

C. R., white male, age 24 years. Admitted to the Hebrew Hospital, February 18, 1910, complaining of swelling over the prepatellar bursa and swollen, painful left knee.

*Family History.*—Father died of Bright's disease. A brother died of tuberculosis. Wife healthy, two sons healthy.

*Past History.*—No serious illness until 20 years of age, when he had typhoid fever. Never had venereal infection. He later had pleurisy.

*Present Illness.*—Patient has had the swelling (nodular mass) over his patella for several years; it has not bothered him. He now complains of pain in the knee-joint which he traces to a fall November 27, 1909, when he struck the left knee; two days later the knee began to be painful. The pain was so great at night that he could not sleep. He was treated in the Dispensary of the Hebrew Hospital, getting relief, so that the pain was intermittent. He could move the leg all right, except when it locked on occasions.

A physical examination showed the patient to be well developed and normal except for a tubercular focus in the apex of right lung.

*Note of Resident Physician.*—The left thigh and leg are smaller than the right. The left knee is thickened and warmer than the right, and tender on both inner and outer sides. There is a lump over the patella the size of a hickory nut, elastic to the touch, freely movable under the skin. The left leg may be flexed on the thigh to a little more than a right angle.

The tuberculin test was positive. There were 8800 leucocytes. Differential blood count:

| | |
|---|---|
| Polymorphonuclears | 57.00% |
| Small mononuclears | 37.50 |
| Large mononuclears | 1.50 |
| Transitionals | 2.50 |
| Eosinophiles | 1.50 |

An X-ray examination showed evidence of foreign material in the joint and the symptoms pointing to such a condition, he was operated upon on February 19, 1910.

*Operation.*—A long incision (4 inches) on the inner side, to include the prepatellar bursa, was made, and a shorter one along the outer side of the knee-joint.

The capsule was incised and a number of tags of a pinkish-yellow color were removed. The largest of these 2½ cm. in length and pedicled, was loose in the joint. After closing the capsule with a continuous silk suture, the prepatellar bursa, a dense fibrous mass, was excised. The skin wounds were closed with subcutaneous silk-worm gut sutures, and the limb put in a plaster of Paris cast.

The wound did badly—the prepatellar area healed by granulation but the joint and surrounding tissues became involved in an active tubercular process until amputation of the limb was necessitated on August 11, 1910.

The mass removed from the prepatellar region, measuring 4 x 3 x 2 cm., was solid, fibrous, glistening white material which cut with difficulty, but showed softer grayish areas here and there. It faded gradually into the surrounding fat.

Microscopically it was a dense fibrous mass containing islands of small round cells, epithelioid and giant cells, and some caseous areas. It extended into the fat tissue by dense fibrous bands.

The tags removed from the joint showed masses of round and epithelioid cells and areas of degeneration.

The examination after operation of the muscle, glands and necrotic material from the joint showed active tuberculosis mostly epithelioid, giant and small round cells, with many polymorphonuclear leucocytes infiltrating the softer parts. Many conglomerate tubercles were present.

## SUMMARY.

It will be seen that our cases correspond exactly to the types of tuberculosis of bursæ containing rice bodies, described, as in the first case, by Nicaise, Poulet and Vaillard, Leriche and Rhenter, and Schuchardt, and in the second case to the sclerosing type described by Reinhardt and Ducroux.

We can add nothing new to their work either in connection with the clinical findings or pathology. We trust that by calling attention to the rarity of the condition and giving references to the best that has been written in regard to this subject, besides adding our own confirmation of their findings, we may aid others in studying tuberculosis of bursæ.

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# A DEVICE TO AID IN KEEPING THE PATIENT DRY AFTER A SUPRAPUBIC CYSTOSTOMY.

By George Walker, M. D.,

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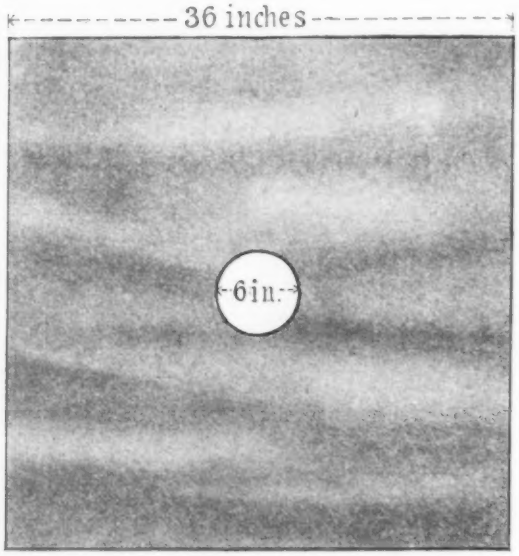


The device consists of a pure gum rubber sheet, 1 yard square, with a round hole in the center 6 to 8 inches in diameter. The material is similar to that used by dentists.

The sheet is laid on the patient immediately next to the skin so that the opening falls over the suprapubic wound. The usual amount of absorbent gauze is then laid on the wound, and the borders of the sheet are folded in, covering the gauze completely. The sheet with the enclosed gauze is held in place by an ordinary abdominal binder or Scultetus bandage.

By this arrangement whenever the gauze becomes saturated the fluid drains into the dependent portion of the sheet, where it collects and allows almost no leakage for several hours, during which time the patient's bed and clothing are kept dry.

When properly adjusted the sheet is also of very material aid in protecting the clothing when the patient is in a wheel chair or walking about.

A large opening in the rubber is necessary in order to supply a sufficient absorptive surface for the gauze.

This arrangement has been found to work admirably with some patients, keeping them almost dry; for others, owing to the configuration of the abdomen, it will prove less satisfactory, but in all cases it undoubtedly adds to the general comfort.

## IN MEMORIAM.

### DR. CHRISTIAN A. HERTER.[1]

Christian Archibald Herter was born in Glenville, Connecticut, September 3, 1865, and died at his home in New York City, December 5, 1910, in the forty-sixth year of his age. His early education, partly by private teachers and at the Columbia Grammar School, was largely influenced and directed by his father, a man of wide culture and scholarly attainments. He was graduated Doctor of Medicine at the College of Physicians and Surgeons (Columbia University) in 1885. He pursued graduate professional studies at the Johns Hopkins University, and later in Germany and France. He was Visiting Physician to the New York City Hospital from 1894 to 1904, Professor of Pathological Chemistry at the University and Bellevue Hospital Medical College from 1898 to 1903, and since 1903 Professor of Pharmacology and Therapeutics at the College of Physicians and Surgeons. He was a member of the Board of Referees appointed by the President of the United States to act as advisers to the Department of Agriculture in the enforcement of the National Food and Drugs Act.

With the incorporation of the Rockefeller Institute for Medical Research in June, 1901, Dr. Herter, who had been active and influential in the preliminary conferences, became a member of the Board of Directors, and served for a number of years as its Treasurer. His death marks the first break in the membership of the Board as originally constituted.

From the date of his graduation in medicine, Dr. Herter's life was one of singular devotion to the pursuit and advancement of scientific medicine—a devotion ever increasing and burning never more brightly than during the last years of a progressive and wasting nervous affection. To this life-work he brought the intellectual qualifications of the successful investigator of nature, good training, industry and enthusiasm. With the scientific temperament was joined, in unusual degree, the imaginative and artistic, in music especially, his accomplishments being those of a virtuoso.

Opportunities for scientific research Dr. Herter created largely for himself, by constructing on the top floor of his house a well-equipped laboratory for experimental, pathological, bacteriological and chemical investigations, and by securing the services and co-operation of able assistants and collaborators. From this private laboratory have issued during the last fifteen years numerous and valuable contributions.

Dr. Herter was a prolific contributor to medical science, his published articles and books numbering not less than seventy, and covering a wide range of activity. His earliest scientific interest related to diseases of the nervous system, his first publications in this field appearing in 1888, followed in 1889 by his valuable study of experimental myelitis, and later by several articles of pathological and clinical interest, and by the publication in 1892, of the first edition of his text-book on "The Diagnosis of Diseases of the Nervous System." After this period his work lay more and more in the domains of experimental pathology, and especially of pathological chemistry, being concerned with problems of metabolism, of the formation of gall stones, of glycosuria, of anæmia and toxæmia and of infantilism; and in the later years particularly with the study of the intestinal bacterial flora and intestinal putrefaction. His lectures on "Chemical Pathology in its Relation to Practical Medicine," published in 1902, met a most favorable reception. He approached pathological problems with broad biological, and even philosophical interest.

Dr. Herter's services to American medicine are not to be measured solely by his published contributions, valuable as these are. The example and influence of his personality and of the ideals which he represented made strongly for higher professional standards and for the wider recognition and cultivation of medical science. The lectureships which Dr. Herter, in association with Mrs. Herter, established upon wise and generous foundations at the Johns Hopkins Medical School and the University and Bellevue Hospital Medical College serve a most useful purpose in the promotion of scientific medicine.

It was mainly through Dr. Herter's instrumentality and generous support that the "Journal of Biological Chemistry" was established in 1905, and he was also active in the organization, in 1908, of the American Society of Biological Chemists.

Biological chemistry in this country owes a large debt to Dr. Herter, whose death after a little more than two decades of fruitful activity is indeed a severe loss to American medicine.

Dr. Herter's services were of great help in the planning and development of the Rockefeller Institute. After the opening last September of the hospital of the Institute, to which he had been appointed physician, and which owes much in its conception and general character as a research hospital to the time and thought devoted to it by him, Dr. Herter began to make use of the opportunities there offered, which seemed to be the fulfilment of his dreams for study of the problems of disease as presented by the living patient. The zeal and ardor with which he entered upon this work seemed to his colleagues wonderful, and indeed heroic, in view of the increasing and distressing physical infirmities of the last weeks of his life.

The memory of Christian Archibald Herter will continue to be a stimulating influence to be perpetuated and cherished as an example of good scientific work, of generous material aid in the promotion of medical science, of devotion to the best interests of his profession, of fine culture, loyalty of character, broad humanity and high idealism.

[1] Extract from Minute prepared for the Rockefeller Institute for Medical Research by Dr. W. H. Welch.

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# NOTES ON NEW BOOKS.

*Œdema: A Study of the Physiology and the Pathology of Water Absorption by the Living Organism.* The Nathan Lewis Hatfield Prize Essay of the College of Physicians of Philadelphia, by MARTIN H. FISCHER, Professor of Pathology in the Oakland School of Medicine, Oakland, Cal. (*New York: John Wiley & Sons. London: Chapman & Hall. 1910.*)

Physiology and pathology depend so much upon the fundamental sciences that any attempt to bring them into closer relations must be welcomed by the medical reader. Dr. Fischer has considered the occurrence of œdema from the physico-chemical standpoint as merely one phase of the whole problem of the transfer of water into and out of the tissue cells, and this in turn as only an expression of the amount of water which the proteids of the tissues can absorb under the conditions in which they are placed. Under this conception conditions which favor absorption by colloids cause the tissues to take up water, while the conditions which lessen the absorption cause the tissues already saturated with water to excrete it.

His fundamental experiment is as follows: "If one leg of an ordinary frog or tree frog or a toad is ligated just above the knee as tightly as possible, so that the ligature shuts off not only the venous flow but also the arterial, and the animal is then placed in sufficient distilled water to cover the legs, the ligated leg develops an intense œdema, while the unligated one remains normal"—in spite of the fact that no circulation can take place through the blood vessels. "*It is clear*," he states, "*that the cause of œdema resides in the tissues themselves and that these become œdematous not because water is forced into them, but because changes take place in them whereby they are enabled to absorb water from any available source.* In the case of the experiments on toads and frogs this available source is the water contained in the dishes in which the animals are kept. In clinical cases of œdema, this is found in the fluids which pass through or about a tissue." The immediate cause for this change in the properties of the tissues he supposes to be the production of acids, especially of lactic acid, in the tissues, which Araki has shown results whenever there is lack of oxygen.

Exactly the same experiments were described in 1898 by Dr. Jacques Loeb,[1] of whom Dr. Fischer was a pupil. In this paper Dr. Loeb demonstrated the formation of organic acids in the muscle after ligation, ascribed it to the lack of oxygen, and demonstrated that the muscle tissue took up water in proportion to the acid formation. It is unfortunate that Dr. Fischer, we believe unintentionally, has failed to do justice to the work of his illustrious predecessor and has described many repeated experiments in a manner which leads the casual reader to regard them as original. In interpretation, however, Dr. Fischer differs somewhat from Dr. Loeb, since he disregards entirely the rôles of cell or capillary walls and is unwilling to ascribe even a secondary rôle to filtration as a factor in the genesis of œdema.

Dr. Fischer gives a good discussion of Overton's theory that the surface of cells is made up of lipoid substances (such as lecithin, cholesterin, protogen, cerebrin, etc.) which in their properties as solvents are unlike ether or the fatty oils, and that only such substances penetrate the cells as are soluble in or miscible with these lipoids. Dr. Fischer himself regards the proteids of the surface as more important than the lipoids. He gives some interesting physico-chemical experiments to show that while acids facilitate the imbibition of water by gelatin, fibrin, muscle and sheep's eyes, this process is inhibited by various salts and inhibited most by the tartrates and citrates. He very ingeniously injects acids into gelatine plates with a syringe and shows that "wheals" are thus formed about the injection very similar to those due to insect bites (in which the poison is also an acid).

Dr. Fischer goes on to apply his theoretical conclusions to various clinical conditions, notably to glaucoma. He regards glaucoma as due to swelling of the colloids of the eyeball, similar to what occurs when the eyeball is placed in acid. He believes that it is independent of circulatory phenomena. Acting upon this suggestion the author and H. G. Thomas have used instillations of sodium citrate and tartrate in the treatment of glaucoma, and claim that the intraocular tension was diminished thereby. This theory of glaucoma has been criticised recently by E. v. Knape[2] and awaits confirmation.

Dr. Fischer also cites some interesting experiments on the removal of experimental œdemas in frogs by immersion in sodium citrate solutions, and states that Dr. John D. Long has successfully treated the œdema about inflamed joints by injection of sodium citrate—a result which the author has been able to duplicate by local injections of sodium citrate in œdematous tissues of cardiac disease and nephritis. These observations, though few in number, are of practical importance. If confirmed by further observation they may lead to a distinct advance in the treatment of œdema.

The rest of the book deals with œdema of the lungs, turgor, plasmolysis and plasmoptysis, the secretion of urine by the kidney and hæmolysis. The two latter sections are interesting and contain some suggestive experiments.

The style of the author is, in the main, clear and interesting. The book is well printed, and although italics are used somewhat freely they enable the casual reader to get some idea of the author's conclusions without a careful perusal of the text. The figures and curves are good and add to the clearness of the subject matter.

The book as a whole contains much and varied information, with numerous references to suggestive articles. In spite of a good deal of special pleading it furnishes interesting reading even where one cannot agree with the author's views.

A. D. H.

*Vicious Circles in Disease.* By JAMIESON B. HURRY, M. A., M. D. (Cantab.), ex-President Reading Pathological Society. (*London: J. and A. Churchill, 1911.*)

In the fight against almost every disease the efforts of the physician may be baffled by the establishment of vicious circles, in which one factor of the malady gives rise to and perpetuates another. Nevertheless, though a foreknowledge of the vicious circles that may be encountered may be almost as essential as the diagnosis and the initial treatment, clear-cut descriptions of vicious circles are rarely met with in textbooks; and in most of the latter only a small percentage of existing vicious circles are mentioned.

In this book Dr. Hurry has given the first systematic collection of the vicious circles which occur in medical practice and has illustrated their mode of production with excellent graphic representations, which add much to the clearness of the text. He has also collected a large number of instances in which the circles may be broken or reversed by therapeutic means. Such a book does not aim to supplant the text-book and is bound in a certain degree to sacrifice accuracy to brevity, but it cannot fail to furnish helpful suggestions to both student and practitioner, and merits the perusal of both.

A. D. H.

[1] Physiologische Untersuchungen ueber Ionenwirkungen, IV. Zur Theorie des Œdems. Arch. f. d. ges. Physiol., Bonn, 1898, lxxi, 469.

[2] Skand. Arch. f. Physiol., 1910, xxiii, 162.

*Text-Book of Massage.* By L. L. DESPARD, Member and Examiner Incorporated Society of Trained Masseuses. Price, $4.00. (*London: Henry Frowde and Hodder & Stoughton, 1911.*) *Oxford University Press.*

Miss Despard has written an excellent chapter on massage, and it is a pity the entire volume is not given to this alone, but the first 175 pages are devoted to the anatomy of the human body, copiously illustrated with pictures more suited to students of advanced anatomy than to those who are anxious to learn massage; only 75 pages are given to the most important part of the work, which is completed by two cursory chapters on bandages and electricity in conjunction with massage. The photographs to show the different methods of giving massage are most satisfactory, and this text-book, even though we feel it is not well balanced, is to be recommended without restriction to students of this art.

*History of Medicine.* By MAX NEUBURGER, Professor of Medical History in the Imperial University of Vienna. Translated by Ernest Playfair, M. B., M. R. C. P. In two volumes. Vol. I. Crown, 4to. (*London: Oxford University Press, 1910.*)

To the Germans especially we are deeply indebted for critical and exhaustive study of the records of the past. Their matchless patience, their tireless industry and perseverance, their vast linguistic resources and their judicial temperament, have borne rich harvests of literature. In no department have the results been more conspicuous and important than in the field of medical history, and the work before us affords striking proof of the fact. As Professor Osler points out in the Preface written by him, "The output in Germany of works and monographs representing scholarship of the first class is equal to the rest of the world put together," and the immediate future is rich in promise of still more important contributions. The libraries of Europe are being ransacked for new and revised Greek and Latin texts, which are to be published under the auspices of the Imperial Academy of Berlin and the Institute at the University of Leipzig for the study of the history of medicine founded by the late Professor Puschmann. Meanwhile, we can feast on the treasures set before us in Gurlt's monumental *Geschichte der Chirurgie* and the more recent encyclopedic general history designed by Puschmann, and on his early death taken up and completed by his pupils, Professors Neuburger and Pagel, the latter of Berlin (1902-5).

It was to be expected that the elaborate researches undertaken in these works, especially the latter, by so many distinguished scholars, would lead to the production of a convenient manual embodying all that is essential for the student and the general reader, and that has been accomplished by Professor Neuburger in the work before us in a manner that gives no occasion for anything but praise.

The subject is treated in a fresh and animated style that holds the reader's interest from beginning to end. The general narrative is given in large type while the details are filled in with small type, an arrangement that is helpful and affords pleasing variety and relief. The principle of evolution is fully and constantly recognized; yet progress has been far from uniform or continuous. "The history of medicine is no calm, unbroken evolution, but a series of advances by fits and starts, with interruptions of subjective influence and with change of scene. . . . . Many of the finest intellects squandered their energies upon grotesque error which obscured many valuable half-truths. . . . . The most brilliant speculative systems barred the way to progress and *a priori* deduction, not reconsidered in the light of experience, served but to lead medicine astray."

Full justice is done to the new discoveries made in Mesopotamia and Egypt, the science of pick and shovel and the elucidation of cuneiform inscriptions having opened to us in the former case the unexpected civilization of the Sumerians, Babylonians and Assyrians, reaching back beyond 3000 B. C., while the famous Ebers and Bugsch papyri in the latter furnish records of little less antiquity. Yet the beginning is not yet, for back of these was an already protracted period of development, of which Babylon and Nineveh were only the most historically important products.

Egypt has left deeper traces upon the memory of man than Babylon, a fact which is to be attributed to its intimate relations with the nations bordering on the Mediterranean, to Jewish and Greek literature, especially the Bible and Homer, and to the striking and mysterious remains found in the Valley of the Nile. But the records already brought to light, according to Neuburger, hardly substantiate the superiority of the Egyptians over their Eastern predecessors, either in religion or science, while their claim to originality is becoming more and more doubtful.

It is interesting to learn that there are traces of auscultation in the Ebers papyrus; also that hygiene and prophylaxis occupied so predominant a status and had reached so astonishing a development among the ancient Egyptians. But other nations, as the Indians, led by their religious views, appear to have paid scarcely less attention to it. Neuburger concludes that it is clear that Egypt exercised a powerful influence upon the social hygiene of the Jews, upon Greek medicine and through these upon the development of mankind.

One of the finest sections of the entire work is that dealing with "the matchless collection of writings bearing the name of Hippocrates, greatest of all physicians," to whom the School of Cos owes its transcendant title to fame. But it can no longer be maintained that these writings emanated exclusively from Hippocrates; "in the light of searching criticism they are nothing but the motley, heterogeneous output of generations, the intellectual product of many thinkers, whose individual voices only chance has united to form a single chorus by no means invariably harmonious." Yet there is an individuality permeating them which is traceable to the strong influence of a single dominating personality. This personality looms up grandly but dimly through the ages, like a stream with many springs, vivifying and inexhaustible; admired by all, really understood by few, imitated by many, equalled by none, the master of medicine for all time. We may conclude that the Hoppocratic ideal will live, unfettered by doctrines, to remotest ages.

Not inferior in breadth and clearness is the section relating to Galen and his system—"the climax of scientific effort in ancient medicine."

One is struck with the frequency with which the author inculcates caution as to final judgment. This applies not only to the medicine of the early periods, the Babylonic-Assyrian and Egyptian, but also to that of later times, as the Arabian. To quote in the latter case: "Since the manuscripts which have been so far investigated bear only a small proportion to the extent of the original literature, and considering the possibility, by no means unprecedented, that research may bring forth surprising discoveries, it follows that we are not at present in a position to express a final opinion upon the achievements of Arabic medicine in detail." This is the true historic attitude of a mind ever open to the reception of new truths and ready to be convinced.

The author's fairness is everywhere manifest and even when forced to condemn he finds something to praise. He seeks to judge events from a contemporary standpoint which is the only way to do justice to them. This is particularly seen in dealing with the Methodists, whose most shining adherent was the celebrated gynecologist, Soranus of Ephesus.

In conclusion, we will only say that we have found nothing to criticise in this incomparable work which will stand for many years to come as the leading text-book on the subject.

The work of the author has been ably seconded by Ernest Playfair, who has given us a spirited and scholarly translation, in which he has steered clear of the German idiom, a thing so difficult to do in translations from that language.

We shall await with deep interest the appearance of the second volume dealing with a much larger subject and one more closely connected with present-day medicine.

The style of the book needs no comment, as the excellence of the Oxford publications is well known.

E. F. C.

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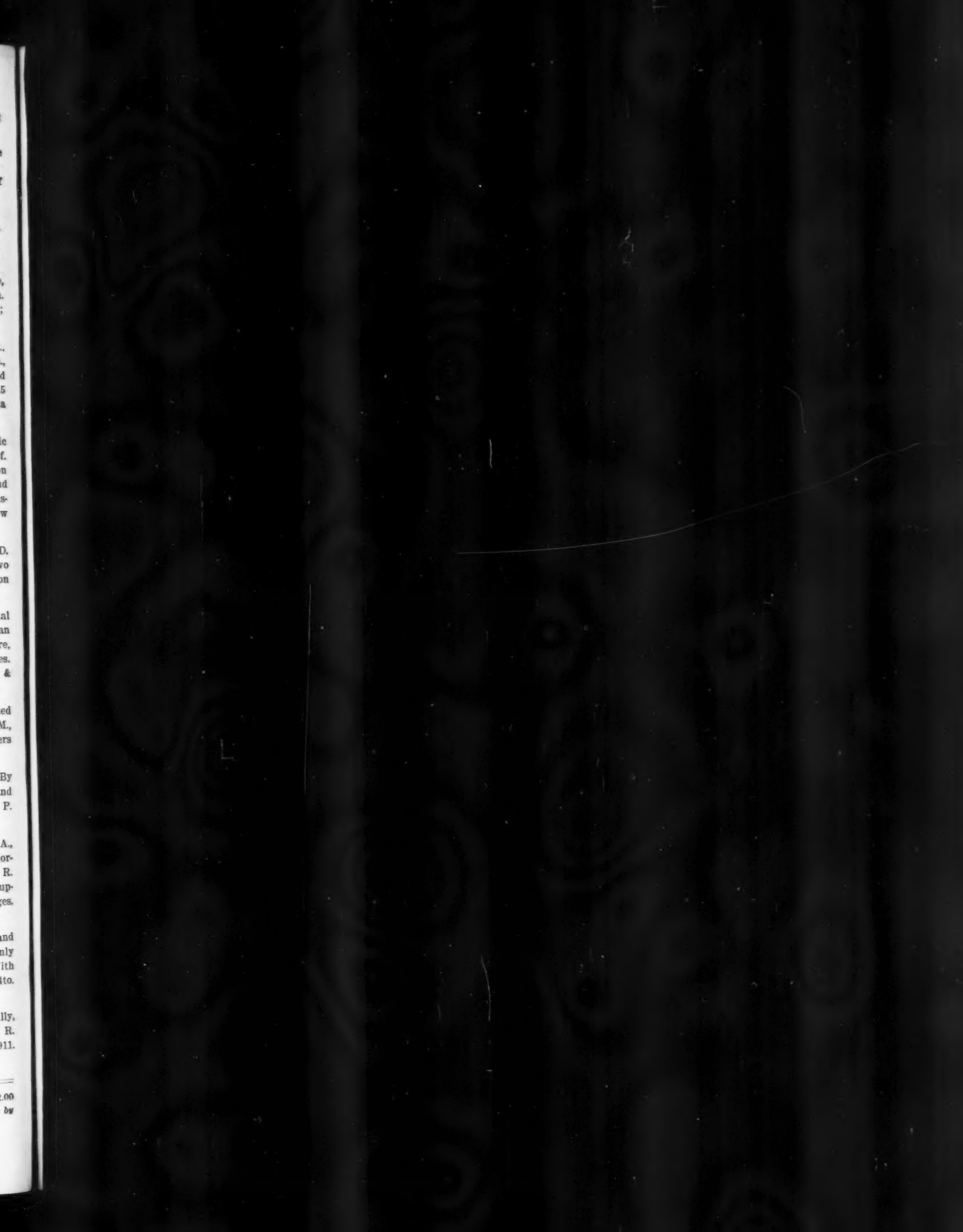
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